FLIGHT

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The Outlook

Again!

IT is not easy to find anything new to say about a new record flight across the world. There seems no limit to the strains which human body, engine, and aeroplane alike can endure. In the air there seems to be no difference between the endurance of the best women and the best men. Naturally there are not so many women record-makers in the world as there are men, but certainly one can point to no man pilot who can endure the strain of flying night and day more doggedly than Miss Jean Batten can, or who can steer his way more unerringly across continents and seas than she. The effort required to keep on the true course when the whole body is aching for sleep, and the eyes are weary with gazing alternately at the distant earth or sea and the instrument panel in the machine, must be one of the greatest trials of the long-range pilot. When storms call for muscular effort to control the machine, endurance must be taxed to near its limit. Yet none of these difficulties ever seems too much for Miss Batten.

As the speed of aeroplanes is increased we may expect still faster flights between Australia and England; yet we may have to wait a long time before the record set up by the Comet flown by Scott and Black is beaten. Solo flights are in a separate category from dual flights, and as a sport they are likely to continue their appeal to adventurous pilots who can afford to indulge in them.

Sometimes the pilots get lost and stranded, and much effort and money is spent in searching for them; and then one feels inclined to question whether the adventurers were justified in running a risk which is so costly to others. The death by starvation and thirst of Keith Anderson and Hitchcock when searching for Kingsford-Smith in North Australia, when the *Southern Cross* was lost, remains as a grim warning of what may happen. Amundsen, too, was lost looking for Nobile and his party in the Arctic. Money is less important than lives, but great sums must have been expended in the vain search for Mrs. Amelia Putnam.

Fortunately, Miss Jean Batten has never caused any trouble of that sort. Perhaps she will now be content to rest on her very bright laurels. Her fame is secure, and her name will always be remembered in the history of flying.

Guaranteed Salaries

UNITED AIR LINES OF AMERICA have decided to pay a guaranteed salary to their captains and reserve captains, regardless of the number of hours flown. Apart from the advantage to the pilots, the new scheme ensures that they will be better able to use their unbiased judgment in deciding whether or not a trip should be attempted in the prevailing weather conditions.

With all the dissatisfaction expressed by pilots over here in the matter of flying pay and retaining fees, with faster machines and winter schedules, this move is one which may well be followed, where possible, by our own operators. A fixed salary gives a pilot a feeling of economic security and consequent contentment.

No one will forget the period when a certain company of mixed constitution was running comparatively few services, and, in consequence, was temporarily overstaffed in the matter of flying personnel. Those pilots receiving high retainers and small flying pay were, somewhat naturally, kept in the air, while others, whose salary consisted largely of flying pay, remained unhappily on the ground.

Since operational reliability is very largely in the hands of the pilots of every company, it is essential that their jobs should be made as stable and sound as those pertaining to any other profession. Flying or route pay there must always be, but the institution of a guaranteed minimum salary would solve a good many problems.

Trans-Tasman

DESPITE the fact that plans for the operation of an Australia-New Zealand service were laid more than two years ago, and that there appears to have been no lack of prospective financial support, nothing has yet been done about it. Presumably the service will have to wait until the Australian and other flying-boat bases are ready, and the Empire boats (including six to be operated by Qantas) are flying regularly to Sydney—which may be some time next year. One can hardly blame the Governments concerned for concentrating their conferencial energy on what, to them, is the more important link in the Empire services.

Nevertheless, it is already possible to travel or to send a letter by air all the way to Australia—whether by land-

BIGGER STILL : Boeing YB-17 long-range heavy bombers of the U.S. Army Air Corps over New York City. Eventually about forty of these Cyclone-powered giants will be in service. Apart from providing useful practical data they have enabled the Boeing concern to solve problems in the construction of four-engined transports and flying boats. An even larger Boeing bomber prototype has flown and is illustrated on page 420.

plane or flying-boat is not germane to the argument. The Tasman service may, therefore, be considered as being of rather greater importance than the mere operational change-over on the present route—particularly as Pan-American Airways propose to start their Pacific service to Auckland before the end of the present year. There is still time to go ahead with this service while work on the trunk route is continuing, and it might be possible to spare a couple of Short boats so that preliminary service can be started early next year. Union Airways should, with New Zealand Government backing, be quite capable of getting down to it in a comparatively short time.

Our Defenders

THERE is probably no side of Air Force work in which the general public takes a more sympathetic interest than in the arrangements for repelling a possible air attack. There is also much ignorance on the subject of air defence. Very few readers of daily papers seem to have any clear idea of how the various items of the defence organisation would work together; first, the civilian Observer Corps sending news of an approaching raid, then the guns and (by night) the searchlights of the Territorial Army coming into action, balloon aprons (worked by men on an Auxiliary Air Force basis) barring the way in unexpected positions and forcing the raiders up high, and, finally, the fighter squadrons, some regular and some Auxiliary, driving home attacks with their machine guns.

It seems a very short time ago that our air defence could boast only a round dozen of fighter squadrons, all stationed at aerodromes laid out for the defence of London. Four days of air exercises always left those twelve squadrons very exhausted. For the Midlands and the North no defensive organisation existed. It was well for us that no enemy attacked us in those days.

Now things are much changed for the better, and the improvement goes on. We have a Fighter Command which comprises two Fighter Groups. No. 11 (F) Group, with headquarters at Uxbridge, is for the defence of London and generally of South-eastern England. It now has at its disposal twenty-one squadrons, of which three are Auxiliaries. They are stationed as follows: Two at Biggin Hill in Kent, two at Tangmere in Sussex, three at Kenley in Surrey, three at Hendon, three at Debden near Saffron Walden in Essex, three at Hornchurch in Essex, three at North Weald in Essex, and two at Northolt in Middlesex.

No. 12 (F) Group is in charge of the air defence of the Midlands and the North, and has its headquarters at Hucknall, near Nottingham. As yet it is not up to the strength which may ultimately be expected, but it has nine fighter squadrons, two of them being Auxiliaries. One of these squadrons is stationed at Hawkinge, near Folkestone, but that must be only a temporary arrangement. The others are stationed: Two at Church Fenton, near Tadcaster, Yorkshire; two at Duxford, near Cambridge; one at Catterick, and one at Thornaby, both in Yorkshire; one at Usworth, near Sunderland; and one at Martlesham Heath in Suffolk. So the Midlands and North are now nearly as well protected as the London area was half a dozen years ago.

Schneider Loadings

IN *The Aircraft Engineer* section of this issue we conclude the article by Mr. A. E. Parker on variable span and variable area. The former subject was dealt with in the issue of September 30, and the author's examination indicated that there is little to be gained by using variable wing span, certainly not enough to make the extra complication worth while.

The title of the article in this issue is, perhaps, a misnomer, as Mr. Parker does not really examine the problems of variable wing area, but rather the effects of putting

successively smaller wings on an aircraft of given gross weight (40,000 lb.), keeping the other features constant. Various opinions as to the value of high wing loadings have been expressed from time to time. Mr. Parker arrives at the conclusion that for an aircraft of about 40,000 lb. gross weight, viz. about the weight of the Empire flying boats, there is a considerable increase of speed (24 m.p.h.) by increasing the wing loading from about 20 lb./sq. ft. to approximately 57 lb./sq. ft., but that, more important still, the saving in fuel weight is, at the higher speed, nearly 2,200 lb. This, as the author points out, may well make all the difference between carrying an economic payload and carrying none at all.

The saving in drag could, of course, be used in other ways. For instance, it can be utilised for increasing the range by throttling down to the original cruising speed, or the weight so saved can be used to increase the payload still further. It is largely a matter of the length of stages which geographical conditions dictate. The point seems to be that somewhere between 55 and 60 lb. sq. ft. is the wing loading which gives the greatest advantage. The seaplanes which took part in the Schneider contests were loaded to more than 40 lb./sq. ft. and managed to take off and alight with such loadings. Commercial aircraft will have to be assisted off, and will also need to be able to release or consume weight in some form or other if they are to alight safely. But that is another story. The advantages of high wing loadings seem to be established. The rest is a matter of catapults, launching rails, composite aircraft, or what have you.

The New Airscrew A.B.C.—

MANY years ago an American firm produced an aeroplane performance calculator. It was a simple affair of cardboard and could probably be manufactured for a few pence. A complete set of performance calculations could be carried out on this instrument in about five minutes, including speed, climb, ceiling, and so forth. Moreover, it was not necessary for the operator of the slide rule to know anything about the subject; provided he was given the gross weight of the aeroplane, the wing arrangement (i.e., monoplane or biplane), the wing sections used, the engine power and engine speed, he had all the material wherewith to carry out the calculations. The work, in other words, could very nearly be handed over to the office boy.

The method of practical airscrew performance calculation evolved by the Research Division of United Aircraft and Transport Corporation, the Airscrew Division of the De Havilland Aircraft Co., and Hamilton Standard Propellers was fully explained in last week's paper by Messrs. F. M. Thomas, F. W. Caldwell and G. B. Rhines before the Royal Aeronautical Society. It does not quite achieve the remarkable simplicity of the American gadget, but, on the other hand, it probably has the advantage that it is a great deal more accurate.

—And Its Reception

AS was to be expected from the nature of the subject, quite a fair number of chief designers from the different aircraft firms were present at the lecture. There is little doubt that in the main they welcomed Mr. Thomas's very excellent exposition of a difficult subject, but it was equally natural that some of them should be slightly sceptical. It is extremely interesting to learn how one firm (or, rather, one group of firms) obtains its airscrew results, but one cannot help feeling that in the future, as in the past, most aircraft firms will be content to supply the airscrew firm with certain data of a new project and ask the airscrew company to produce the airscrew figures which can reasonably be expected. Mr. Marcus Langley put it rather neatly when he said that he did not care a hoot whether the answer to his query was supplied by theory or by Mr. Thomas's method. All he was interested in was results.

That the new method of airscrew performance calculations is not likely to supplant the theoretical methods when used by the specialist in airscrew design is, of course, to be expected, and this point of view was ably upheld by Dr. H. C. Watts. Dr. Watts paid tribute to the work of the late Mr. Glauert, and by way of showing that the theoretical methods need not be slower than the one explained by Mr. Thomas, he pointed out that Mr. Lynam had carried out test calculations by the theoretical method which agreed on the whole very well with those obtained by Mr. Thomas. The work of calculating these figures occupied only 25 minutes! But one assumes that to be merely another way of saying that curves or tables based on theory produce results in the same time as curves or tables based on statistics.

All Metric

DESPITE the slight difficulty involved for all concerned, it seems that the time has come for the aeronautical community to change over completely to the metric system so that transport pilots and others need only think in one series of units. British Airways already have their machines fitted with metrically calibrated instruments, and several other concerns are tending to follow this lead—which was, we believe, originally taken by British Continental Airways in the equipment of the later items of their fleet.

For internal operations the matter is of little importance, but nearly all transport concerns and the majority of private owners make use of Continental radio and meteorological services. In the ordinary way every morsel of linear information must be laboriously converted for use with the standard instruments—and this translation, though taking only a matter of seconds where an experienced crew is concerned, should not be necessary.

More important still, perhaps, as a correspondent of *The Times* recently pointed out, the time may come when our Air Force is co-operating with that of another country, and the different systems can hardly be reconciled in a week. It is not quite sufficient that our radio wavelengths should be given in metres and kilocycles.

Lefts and Rights?

A SUGGESTION has been made that air defence would be considerably helped if a corps of sportsmen were formed to man our anti-aircraft batteries. The theory is that men who are experts at shooting driven grouse and pheasants would be better than ordinary Territorial gunners in potting the speedy bomber.

There is little doubt that expert shots with the scatter gun would be welcomed either as officers or as gunners by the commanding officer of any A.A. brigade of the Territorial R.A., but there is great doubt as to whether their experiences outside the coverts or on the moors would bring them a larger bag of bombers than is likely to fall to the gunners trained on present lines. Game-shooting is largely a matter of hand and eye, based probably on a natural gift reinforced by practice. Ballistics have to be studied by the rifle shot, but do not deeply concern the gun shot, whose weapon has a comparatively short range and makes a large pattern.

Hand and eye can have little to do with successful shooting at aircraft. The problem is worked out for the gunner by the predictor. Even before the predictor was generally available, "Archie" had attained considerable proficiency so long as two conditions were granted. These were that the bomber must fly on a straight and also on a level course. If Mr. Bomber will so oblige, the predictor will enable the guns to bag him. If he begins to "gyre and gimble in the wabe," then the odds are that the expert grouse shot, or even the snipe shot, will miss him. Even the predictor cannot predict his movements.

The said sportsmen would probably do better service to their country in the Machine Gun Corps—or why not in the R.A.F. Volunteer Reserve?

DIARY OF FORTHCOMING EVENTS—PAGE 426b

This photograph of the Link Trainer installation at the U.S. Bureau of Air Commerce gives a good idea of the general layout and of the size of the Trainer itself. The hood and door of the machine are shown open.

BLIND FLI
on th

The American Link Trai ction bilities Outlined : Mo for

By WING COMMANDER G. W. WILLIA M.C.,

BLIND flying has come to stay. But unless pilots are carefully trained and fully experienced accidents such as those which have occurred on American transport services within the last twelve months are always possible. The real difficulty is that of providing a prolonged blind-flying training course without the high cost of continuous flying. This problem appears to have been solved. Blind flying, and all that goes with it, will in future be taught on the ground.

Instead of a training machine with a hood, in which both pupil and instructor must fly for many hours, a model aircraft is now housed in a comfortable room, and the pupil is able to experience all the sensations of blind flying without leaving the cockpit of the stationary fuselage. This remarkable apparatus, known as the Link Trainer, has been produced by the J.V.W. Corporation, whose London office is at 30, Chester Street, S.W.1. A large number of these ground trainers are being made for the R.A.F., and it is appropriate that the London office should be in charge of Air Commodore P. F. M. Fellowes, D.S.O., R.A.F. (retd.).

When the pupil seats himself in the cockpit of this apparatus he finds the usual control column, rudder bar and an instrument dashboard fully provided with all the indications required for blind flying. The instruments in front of him include, approximately in the order in which they appear, a magnetic compass, air-speed indicator, engine revolution indicator, sensitive altimeter, directional gyro, and gyro horizon. In addition, the type in use in America is equipped with the necessary transmitter and receiver for speech, together with the indicator used to show whether or not an aircraft is flying in the radio beam of one of the airports. It is possible that for trainers to be used in this country the Air Ministry may require an instrument layout comprising the blind-flying panel described in a recent issue of *Flight*; this would not add any new instruments to the series listed above, although it would have the great advantage that pilots passing from the Link Trainer to actual blind flying on a Service aircraft would already be accustomed to the Service layout.

The fuselage is mounted, or rather pivoted, well clear of the ground. It is coupled to a series of powerful bellows in such a way that movement of the controls will tilt the model aircraft into attitudes corresponding to those of real flight. Pressure on the rudder bar will result in a turn; bank is applied, as usual, by means of the control column, and if that bank were not sufficient for the rate of turn the needle of the turn and bank indicator will show that a sideslip is taking place to one side or the other. The appropriate movement of the control column will also put the little machine into the attitude of climb or dive. And it is one of the most ingenious and valuable features of the scheme which ensures that the response of the instruments to changes of attitude corresponds with that of actual flight.

For example, if the control column is pulled back the aircraft will take up a climbing attitude to a maximum of 50 deg. This will, of course, be shown on the artificial horizon; but, in addition, the vertical speed indicator will show the rate of change of altitude, the altimeter needle will indicate the amount of height gained, and the air speed, as well as the engine revolutions, will appear to fall.

A word of warning is necessary concerning this uncanny correspondence between instrument indications and movements. If the throttle is opened engine revolutions will increase; since there is no engine, something has been done to the inside of the r.p.m. indicator. Similarly, after 30 minutes' "climbing" the altimeter may show 10,000ft., but the actual altitude would be 64in. The instruments may bear famous names—Smith, Sperry, Reid and Sigrist; but some of them are, after all, only dummies, though it is remarkable how closely they simulate the real thing. The artificial horizon, for example, has no gyro, and turn indicators will certainly require some faking to make it appear that the Trainer, pivoting at 360 deg. a minute, is making the same manœuvre as an aircraft swinging round a turn at 200 miles an hour.

Sensitive Controls

The control column and the rudder bar are very light in operation, and this feature ensures that the pilots, when actually flying blind in service, will not be subject to the usual error in instrument flying—that of over-controlling. Practice with a Link Trainer invariably results in a light touch upon the controls of a real aircraft whether flying blind or not.

The model aircraft itself must, to use the old phrase applied by war-time pilots to non-stable aircraft, be "flown all the time." Unlike any modern aircraft, it has no natural stability whatever; and this fact, combined with the very light touch necessary for its proper control, requires a very high degree of concentration from any pupil, or even an experienced pilot, who handles this machine for the first time.

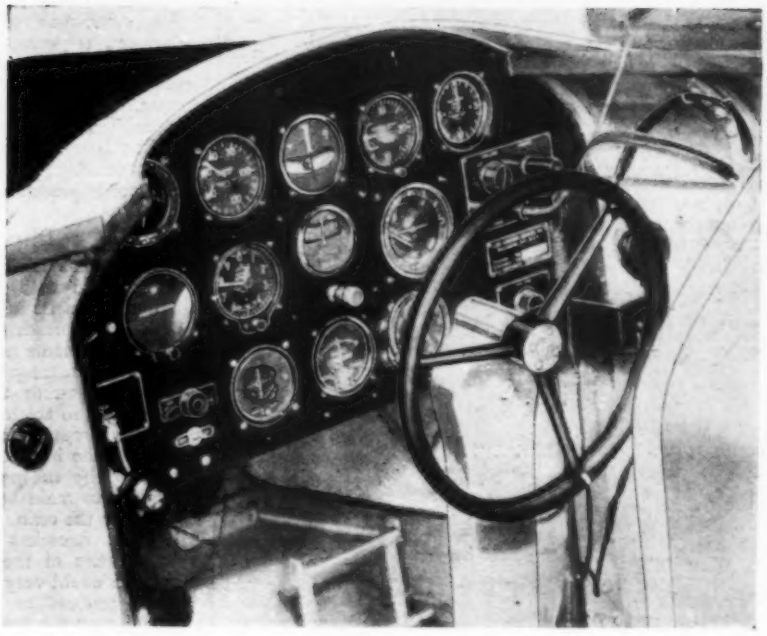
By the time a pilot arrives at the stage where blind flying is to be taught he will already have had a reasonable number of solo hours in the air and will be accustomed to all the manœuvres of real machines; instruction on the Link Trainer begins in much the same way as his *ab initio* flying began.

He must first learn to fly this highly unstable machine straight and level. These and similar initial exercises

FLYING ON THE GROUND

Training Action : Its Immense Possibilities : Models for Different Purposes

By WILLIAM . . . M.C., M.Inst.C.E., M.I.Mech.E., M.I.E.E.



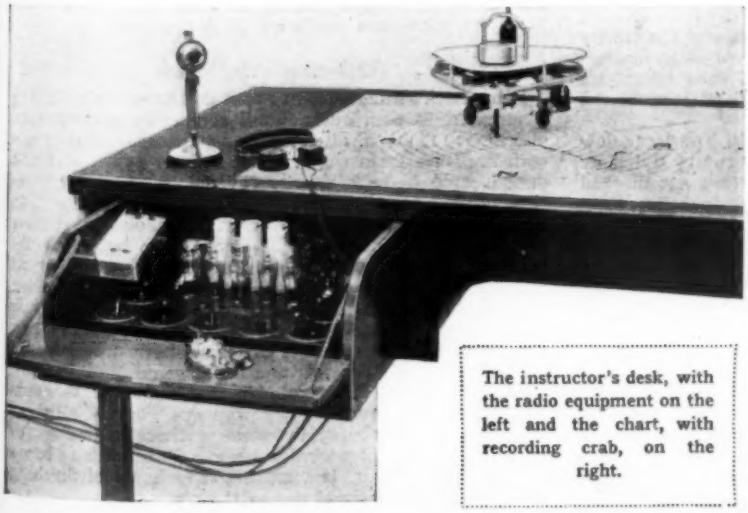
A typical instrument layout which, in this case, is designed for American transport training. From left to right the instruments are : (top row) Compass, A.S.I., turn indicator, rate-of-climb indicator, and revolution counter ; (middle row) marker beacon signal, sensitive altimeter, directional gyro, artificial horizon and radio control panel ; (bottom row) blind approach indicator, radio " homing " indicator and clock. The throttle and engine controls are on the left.

must necessarily be carried out with the hood open ; that is, the pupil must first learn to " fly " the Link. Having mastered straight and level flight he can essay slow turns, and although he is provided with a rate-of-turn indicator as well as a directional gyro, he may be called upon to make turns for a certain number of seconds instead of through a certain number of degrees—the time in seconds to be estimated by himself. A particular exercise will require him to bring the machine quickly and accurately to a compass heading, in which manœuvre he will, of course, see that the machine is properly banked, either checking the indication from the turn-and-bank indicator or the ball in the glass tube of the directional gyro.

Slow turns having been mastered, the pupil can proceed to fast ones, and finally to a spin. As the fuselage rotates through 360 deg. and tilts in any direction up to 50 deg., the spin may be quite realistic ; excellent practice can be obtained in making a rapid and accurate recovery. The procedure follows the accepted lines of recovery from a spin in which the pilot is flying blind or is under the hood: First, to stop the turn ; secondly, to centralise the ball or the top needle of the turn-and-bank indicator, and then to adjust the speed or pitch to that required for level flight.

When the machine can be flown straight and level, turned fast or slow and put into a spin and recovered from it, the pupil is ready to begin blind flying under the hood.

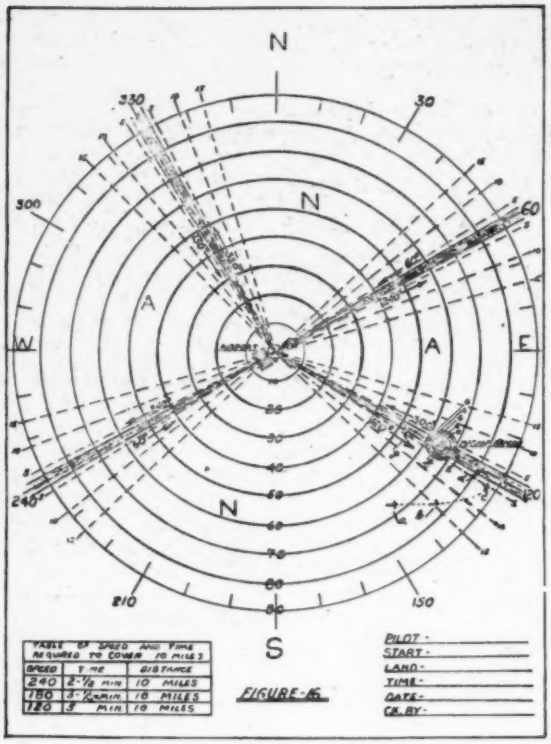
In blind flying with a real machine the pupil is under the hood and the instructor in the other cockpit ; with a Link Trainer the pupil is under the hood and the instructor sits at a table a yard or two away. On the table before him is a map of the country over which the pupil is supposed to be flying, and on that map there moves a small three-wheeled trolley which reacts, as regards the rate and time of any turns made, to the movements of the Trainer fuselage. In addition, however, this control, or crab, is being driven across the table at a speed corresponding to the supposed progress of the Trainer across the country below. If, therefore, a pilot under the hood decides to fly due North for 15 minutes at a certain air speed the crab also moves due North at a speed proportional to that of the aircraft, and depending upon the scale of the map on which it is set. The trolley is connected to the Trainer by flexible cable ; one of the wheels acts as an inking pen and marks either the map or a piece of tracing paper over it with a line showing the course flown by the pilot under the hood.



The instructor's desk, with the radio equipment on the left and the chart, with recording crab, on the right.

In some ways the training of American air-line pilots would be rather more simple than the training of Service pilots in this country, necessarily flying with very little reference to radio aids to air navigation. For example, an American pilot is taught at an early stage to fly along the beam leading to the required airport ; the exercises he must carry out correspond to the problems which he will be required to solve in real blind flight.

The instructor may place the trolley upon a particular radio beam marked on the map and inform the pupil that he is to fly along that beam until he reaches the airport, which he can identify by the so-called " cone of silence " over the aerodrome itself. The Link Trainer does not require the complication of actual correspondence



Although the type of chart used for Service and transport training in this country is likely to be rather different, this chart of an American radio range station and its environs is typical of the sort of thing over which the marking crab moves on the instructor's desk. Needless to say, charts of almost any design may be used for different training "flights."

with a real beam station, but when the instructor puts the trolley in a beam he is able, by means of a wireless set at his left hand, to simulate the signals in the earphones as well as those on the visual indicator, which will provide an American pilot with exactly the same information as if he were flying in an actual beam. Therefore, the instructor can make his signals loud or soft, so that the pupil would deduce whether he were near to or far from the transmitting station; and, as air-line pilots flying towards an airport are instructed to keep to one side of the beam so as to avoid the possibility of collision with out-going pilots keeping to the other side, the instructor is also able to vary his signals according to the position in which the trolley has been placed relative to the centre of the beam as shown on the map. A slightly more difficult exercise could be given if the instructor placed the trolley north or south of the beam and told the pupil to find his beam, turn the right way along it, and then adjust his course so that he is flying in the right-hand edge of the cone of signals.

Instruction in this country will probably pass from slow turns, fast turns, and spinning, to cross-country flying by means of instruments only. Our maps are not marked with radio beams, so the instructor will doubtless plant the trolley over some town such as Andover and instruct the pupil to fly to Croydon; if the R.A.F. Link Trainers are to be fitted with wireless sets the pupil might be required to carry out a blind-flying landing with the aid of the equi-signal beacon. In this country there are very few high mountains; but if, between Andover and Croydon, there were a range of hills 10,000ft. high, it would be necessary for the pupil to notice this by examination of his map and to adjust accordingly the altitude at which he would make his cross-country flight. The instructor might also inform the pupil that there was a wind of certain strength and direction stated, in which event the pupil would have to adjust his heading so as to follow the required track. As a further test of concentration, the model aircraft can be shaken in a manner corresponding to that in which a real aircraft is buffeted in rough weather.

A somewhat more difficult exercise could be easily designed requiring the pupil to fly a triangular course, making turns at points which he would have to determine himself by calculation of his air speed and the known strength and direction of the wind. The crab would inexorably record the track which his aeroplane had flown, and as experience was gained in making such cross-country journeys the pupil would be able to see from the series of records produced the rate of his improvement.

Blind Approach Training

Finally, as Link Trainers for the Royal Air Force are being fitted with Lorenz blind landing indicators, blind landings can be attempted. The instructor can place the crab in the beam of the equi-signal beacon and, from his own instruments and the movement of the crab, see how the pupil manages to enter the constant-note segment, throttle back at the first marker beacon, and hold the glide path to the last beacon. The signals received by the pupil will not, of course, be real ones; they will be those sent by the instructor to simulate signals which would be received by the pupil if his aircraft were in the position, relative to main beacon or landing beacon, which is indicated by the crab.

These exercises most certainly do not exhaust the possibilities of the Link Trainer. Any blind-flying instructor could very easily devise a graded series of exercises in all probability much better suited to R.A.F. requirements than the brief outline given above. The very great value of this equipment both to the R.A.F. and to large-scale civilian air-line operators is enhanced by the wide range of practical problems which can be imposed upon pilots as well as by the very high proportion of blind-flying training which can be carried out on the ground.

Success depends, of course, upon the instructor, and it would not be difficult to name at least one item of high-grade ground equipment which was not as successful as it should have been owing to the lack of suitably qualified operators.

If such valuable equipment is to be fully used, instructors must be available from the very start and in sufficient numbers to provide pupils with a very comprehensive training. In the R.A.F. any well-qualified blind-flying pilot can act as instructor up to the stage at which cross-country flights are undertaken by the pupil in the Link Trainer. But if this apparatus is used by air-line operators a much wider syllabus of training will be required for the instructors who are to produce well-qualified blind-flying air-line pilots. That syllabus would include not only familiarity with the considerable range of instruments with which any large aircraft is at present equipped, but also the indications of the various radio aids to navigation in this country and on the Continent, together with a thorough knowledge of Air Navigation Directions. It seems necessary that instructors should study the problems for at least a month in order to ensure maximum efficiency in its operation.

Reducing Air Work

It has been estimated that about 20 hours of blind flying is required to turn out a pupil competent to undertake instrument flight in all weather conditions. Experience with the Link Trainer shows that at least 15 hours of this period could be satisfactorily covered by ground instruction, leaving only five hours' blind flying in the air. The first 60 minutes would be spent with the hood open; after that time the pupil would be expected to be sufficiently familiar with the controls and the instrument equipment and able at least to undertake slow turns with the hood closed. Instruction on turns, slow and then fast, spinning and recovery from a spin, might be spread over another four hours, making a total of five hours for instruction only on the use of the controls and instruments.

In this country it is probable that a further 10 hours could be spent in cross-country problems, especially if these are to be supplemented by wireless direction finding, or landing by means of a wireless beam. This totals 15 hours in the Link Trainer, leaving only five hours of finishing instruction to be carried out in the air.

The operation and capabilities of the Link Trainer are probably of more interest than its mechanical features. The fuselage, with its stubby wings, tailplane and rudder, is mounted upon a square fixed base, and the bellows, by which various pitching and rolling movements are effected, are operated by a small electric motor driving a vacuum turbine. The air for these bellows is controlled by the control column and rudder bar by a system of valves in such a manner that the Trainer banks, turns, climbs, dives, or spins in response to these controls exactly in the same manner as in a real machine.

It is essential that the room in which the Trainer is installed should provide free movement for the little aircraft, together with ample space for a table sufficient in area to take the largest sizes of maps used. The room, for example, should not be less than 20ft. by 25ft., and it is a convenience to have a rather wider door than usual as the Trainer requires a space 74in. high×37in. wide. The height of the room should be sufficient to allow the Trainer to take up any attitude when the hood is up; the ceiling, therefore, should not be less than 10ft. high. Like any other mechanical device, the Trainer requires periodic inspection, and full instructions are provided in the operating manual. The cost of running is particularly low and is confined to the electrical supply of a small motor operating the bellows.

Large economies in time and money, together with greatly increased efficiency of instruction, are possible by the use of ground training of this kind in preference to much more expensive and far less concentrated training in the air.

JEAN BATTEN SUCCEEDS AGAIN

From Port Darwin by Percival Gull (Gipsy Six) in 5 days 18 hours 15 minutes : Out and Home Australia Records Now to Her Credit

AT her present rate of progress, long-distance flights by Miss Jean Batten in her Percival Gull will soon cease to be "news," just as the monotonously reliable Atlantic crossings by *Caledonia* and her sister ships came to receive only mere mention in the newspapers.

Miss Batten's most recent achievement, a record flight from Australia to England, clipped 14 hrs. 10 min. off the previous best time, made by Mr. H. F. Broadbent last May. Mr. Broadbent's time was 6 days 8 hrs. 25 min., and the new record 5 days 18 hrs. 15 min. Incidentally Mr. Broadbent abandoned an England-Australia attempt last week.

Last Sunday afternoon Miss Batten received a great and well-deserved welcome from friends and admirers in the air and on the ground at Lympne and later at Croydon. She had experienced very bad weather conditions after leaving Damascus, and, having time in hand on the last day, decided to call in at Marseilles for weather reports and a breather, although her machine has a range of over 2,250 miles, which would have been sufficient for a single "hop" from Rome.

The worst conditions of the flight were experienced near Naples, and Cyprus was missed altogether. Miss Batten averaged only eight hours on the ground each day, of which about four were for sleep; even so, her trip with a faster machine was a good deal less strenuous than Mr. Broadbent's. At Damascus she allowed herself eleven hours' rest, having decided to turn back to Damascus when over the mountains of Lebanon. It was a fortunate decision, for news was sent later that Nicosia Aerodrome, Cyprus, for which she was making, was flooded and unfit for landing.

A happy photograph of Miss Batten framed in the cockpit of her Gull. Behind her can be seen the petrol tank which in the tropics became too hot to touch.

A dull afternoon greeted Miss Batten on arrival at Lympne. Her Gull is here seen over Kent *en route* for Croydon.

Times at principal aerodromes on her route are as follows:

9.30 p.m., Monday (October 18), left Port Darwin.
9.15 a.m., Tuesday, arrived Batavia.
2.25 a.m., Wednesday, arrived Alor Star.
10.6 a.m., Wednesday, arrived Rangoon.
6.15 a.m., Thursday, arrived Allahabad.
1.40 p.m., Thursday, arrived Karachi.
7.30 a.m., Friday, arrived Basra.
2.30 p.m., Friday, arrived Damascus.
9.20 a.m., Saturday, arrived Athens.
3.45 p.m., Saturday, arrived Naples.
3.45 p.m., Sunday (October 24), arrived Lympne.

The Percival Gull with 200 h.p. Gipsy Six Series I engine is standard except for extra tankage in the cabin, and is the same machine with which Miss Batten set up the present England to Australia and England to New Zealand records. The fuel arrangements, extra to the ordinary wing tanks of 20 gallons each, consist of two special centre section tanks holding 8½ gallons each and an 85-gallon cabin tank, totalling 142 gallons, and giving the machine an endurance of about 14 hours. There is an auxiliary oil tank, with hand pump, in the cabin.

The proprietary equipment and components of the Gipsy Six Series I engine included the following:—

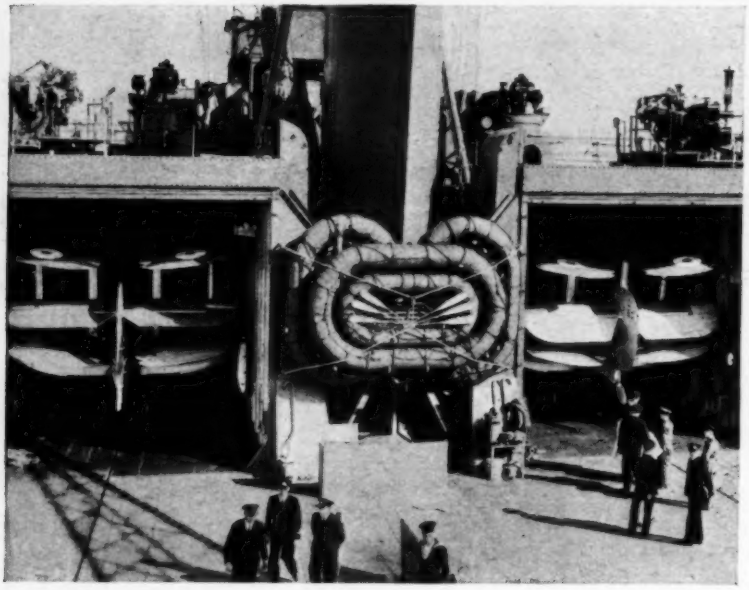
E.S.C. crankshaft, Weyburn camshaft, Hoffmann bearings, Wellworthy piston rings, Salter's valve springs, B.T.H. magnetos, K.L.G. plugs, cables by British Insulated Cables, Claudel Hobson carburettors with Amal flame traps, Amal fuel pump and Rotax starter, generator and battery. Shell aviation fuel and Patent Castrol XXL oil were used.

The proprietary equipment of the Percival Gull included:—

Smith's engine instruments, Husun P.4 compass, Reid and Sigrist turn and bank indicator and fore and aft level, Demec navigation lights, Palmer wheels, brakes and tyres, Bamberger spruce, plywood by the Aeronautical Panel and Plywood Co. and the Cork Mfg. Co. (Flexo), Titanine finish, Rhodoid windscreen, Splintex glass windows, Rumbold upholstery, Moseley float-on-air cushions, Bessbrook fabric, Reynolds special tubing. Tanks and certain sheet metal work were by E. G. Brown and Co., Ltd.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS



LOCK-UP ACCOMMODATION : *H.M.S. Sheffield*, a cruiser of the new City class, carries two Supermarine Walrus amphibian flying boats, which are housed as shown above. Of 9,000 tons displacement, the *Sheffield* has twelve 6in. guns and eight 4in. on twin high-angle mountings. Provision is made for a third aircraft. A multiple pom-pom, bug-bear of dive bombers, will be observed above the starboard hangar.

PLANS for the aerial defence of the Port of London are said to be so satisfactory that they have been adopted by the Government as the basis of the defence in wartime of all ports in the United Kingdom.

No. 204 (G.R.) Squadron is to fly its Saro Londons to Australia early next year to take part in the celebrations of the 150th anniversary of the first white settlement in the Commonwealth. The C.O. is Sqn. Ldr. V. P. Feather.

Sir Hubert Wilkins has left for the Arctic in a new attempt to find the six Soviet airmen who are believed to have made a forced landing during a trans-Polar flight and who, it is firmly believed in Russia, are still alive.

Five Italian Romeo reconnaissance biplanes, bought by the Austrian Army with money subscribed in the province of Upper Austria, have been handed over to the Minister for Territorial Defence.

The Royal Aero Club is to give a house dinner to Miss Jean Batten next Wednesday, November 3, at 7.30 p.m. The chairman will be Mr. W. Lindsay Everard, M.P. Tickets, at 6s. each, will be available to members only.

Mr. Lincoln Ellsworth, the Polar explorer, was presented last week with the Patron's gold medal of the Royal Geographical Society for his work in developing the technique of aerial navigation in the Polar regions, culminating in his flight across the Antarctic in 1935-6.

Flight Captain Hanna Reitsch, the only woman in Germany to hold this title, is reported to have flown the Focke-Wulf helicopter sixty-seven miles from Stendal to Berlin. A current news film reveals some outstanding qualities in this machine.

Indications are that France is starting a big drive for world's records. Last week Curvale, in the Bloch 160 (four Hispano X of 690 h.p.) covered 1,000 km. with 5,000 kg. load at an average speed of 317 km./hr. His figure for 2,000 km. was 307 km./hr.

Using the new tapered wing Farman 2231, flown, as was the Bloch, in the Damascus race, Lucien Coupet averaged 262 km./hr. over 1,000 km. with 10,000 kg. The Farman was using similar engines to those in the Bloch, and is the prototype of a transatlantic series and of a high-speed heavy bomber.

It seems that the Martin flying boat for Russia (four G-type Cyclones V; all-up weight, 62,000lb.; top speed, 190 m.p.h.) is being assembled in the open air at the Baltimore factory. This machine resembles closely the Martin 130 Clipper, but is much bigger and has twin fins and rudders.

The Ryan concern has introduced a new side-by-side cabin two-seater of all-metal construction. The engine is a Menasco and the top speed should be in the region of 150 m.p.h. A number of Ryan braced-monoplane trainers have been ordered by Mexico.

Twenty-five Years Ago

(From "Flight," October 26, 1912.)

"Arriving at the Hendon Aerodrome, about 9.20 on Saturday morning, Mr. Sydney Pickles heard that a pack of hounds in full cry had crossed the aerodrome about ten minutes before. As he had never seen an English hunt, he thought it would be a good idea to follow it by aeroplane, and so got the Caudron biplane into the air, and in a few minutes had sighted hounds. He followed the hunt for about ten minutes and then returned to the aerodrome."

THE WORLD'S LARGEST LANDPLANE : The Boeing XB-15, which is much bigger even than the YB-17s illustrated on p. 414, and which is probably the largest landplane now flying, spurns back the soil on an early test take-off. Designed in the first instance for engines of 1,500-2,000 h.p., she is fitted at the moment with four 1,000 h.p. Twin Wasps.

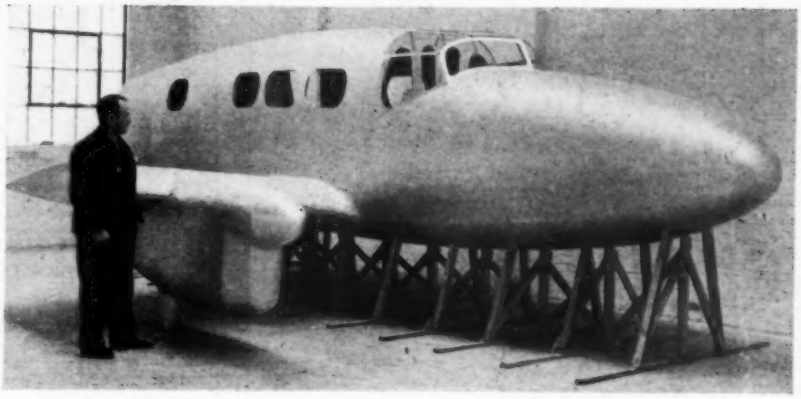
SWAN and CYGNET

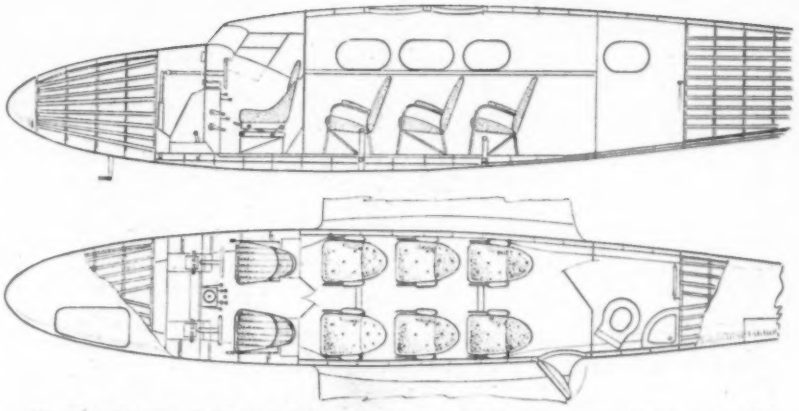
Advance Details of the C. W. Swan Light Transport and the Production-type Cygnet

UNDER the courageous guidance of Messrs. C. R. Chronander and J. I. Waddington, C.W. Aircraft are well into a batch of Cygnet all-metal cabin two-seaters and are preparing detail drawings for a high-speed six-eight-passenger transport of the most modern conception. The elaborate mock-up of the transport which has been built foreshadows a low-wing cantilever monoplane of classically beautiful lines and, considering the high performance promised, a surprisingly commodious interior. A number of operators have already been down to Slough to assess the value of the Swan, as the projected type is known, for charter and feeder-line work over distances up to 700 miles. Captain Olley expressed his eagerness to give the prototype a "service trial."

The Swan design which is to be realised should not be confused with a projected machine first illustrated in *Flight* of December 10 last year. This was a smaller model with two Villiers-Hay Maya engines, whereas the current design is being stressed for units of as much as 450 h.p. each. The early design also embodied the "tadpole" fuselage of the type which has given such encouraging results on the Cygnet, but this layout was found impracticable where a large cabin, extending some distance aft of the trailing edge of the wing, was called for. Accordingly the new Swan has a more-or-less conventional fuselage of extraordinarily pleasing shape. Mr. R. S. Dickson, whose ability is reflected in a marked degree in the performance of the Spitfire, has a pronounced aversion to straight lines, and consequently, as will be gathered from the G.A. drawings, the Swan's fuselage is a joy to behold.

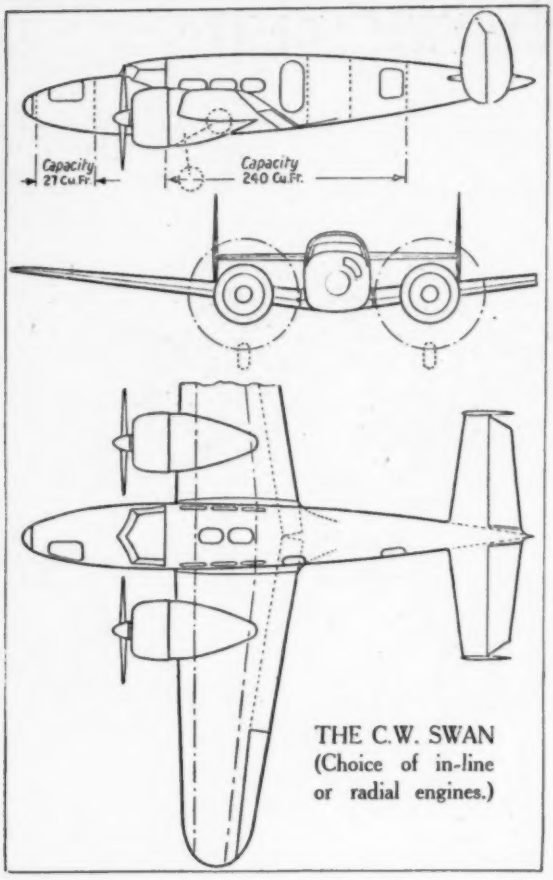
Quite apart from its obvious advantages as a purely commercial proposition, the Swan could easily be produced as a luxurious private-owner or business executive type or as an advanced twin-engined trainer, reproducing the characteristics





Mr. R. S. Dickson, C.W.'s chief draughtsman on the Swan, surveys the mock-up of his very efficient-looking design. The nacelles, it will be noticed, are for Gipsy Sixes, although the prototype may have Wasp Juniors. The drawing shows that commodious baggage compartments and, considering the performance, a roomy cabin, characterise the machine (*Flight* photograph).

(Left) The wind-tunnel model of the Swan less nacelles. Note the extraordinarily neat tail (Right) The amply wide cabin gangway and the central control bank in the cockpit are features revealed in this view taken in the mock-up (*Flight* photograph).



Engines.	Gipsy Six Series I.	Gipsy Six Series II.	Wasp Junior S.B. or Whirlwind 875-E-3.
Airscrews (metal)	Fixed pitch	V.P.	V.P.
Undercarriage	Fixed	Retractable	Retractable
Maximum b.h.p.	2×200	2×205	2×450
Tare weight complete with cabin furnishings, toilet, etc. lb.	3460	3660	4460
All up weight including 6 passengers with luggage and 2 pilots, lb.	5800	6000	7000
Maximum speed, m.p.h. ...	190	205	250
Cruising speed, m.p.h.... ...	165	175	225
Cruising range, miles	660	700	700
Rate of climb at sea level, ft./min.	900	1000	1500
Price with normal equipment...	£6,500	£7,500	£9,000

Dimensions: Span, 46ft. 0in.; Length, 36ft. 0in.; Height (tail down) 10ft.

of large bombers and trunk-line transports, for coastal reconnaissance, ambulance work or aerial survey.

The least expensive "case" for the Swan calls for Gipsy Six Series I engines with fixed-pitch airscrews and non-retractable undercarriage. Series II "Sixes" and variable-pitch airscrews, in conjunction with a retractable undercarriage, confer a very marked increase in performance, but the practical ultimate in speed is obtained with a pair of 450 h.p. Pratt and Whitney Wasp Junior or Wright Whirlwinds of similar output. Other power plants which suggest themselves are D.H. Gipsy Twelves, Walter Sagittas or Fairchild Rangers (all inverted vees), Bristol Aquilas (temporarily out of production owing to the exigencies of expansion), Napier Rapiers or the economical American Jacobs.

The main structure of the Swan is of the stressed-skin light alloy variety, the heavily loaded portions being of high-tensile steel. Particular care has been taken to guard against corrosion, the greater part of the skin being of Alclad which requires neither protective covering nor routine inspection.

Wing Construction

While the fuselage construction is fairly orthodox, with hoops and stringers, the wing construction is distinctly unconventional, the spar booms being of Reynolds tubing. At the root end the booms are five tubes thick but there is a progressive thinning out toward the tip where there is just a single 2in. tube. The employment of tubing makes not only for simplicity but for great economy.

The pilots' cockpit of the Swan has a windscreen of fairly conventional design, a suggested moulded version, which goes much further toward preserving the fine fuselage lines, having been temporarily shelved because most air line pilots seem to have very fixed and conservative ideas about screen design. The cockpit has side-by-side seating with dual Stinson-type wheel controls protruding through the dashboard with all their attendant works out of sight behind. The essential control levers are arranged on a bank or box on the centre line with the compass mounted on top, where, it is to be hoped, it will be quite happy amid so much metal. A careful choice of material for the control bank is indicated here. The elevator and rudder tab lever are on either side of the bank, together with the flap and undercarriage controls. Throttle, mixture and airscrew controls are mounted in gates on the front of the bank.

Mr. Chronander is especially interested in the patent flap which will be incorporated. This will have a rearward and downward motion and will benefit take-off and landing.

Radio is arranged under the dash, the transmitter being in front of the second pilot and the receiver in front of the captain. Generator and master controls are between the seats.

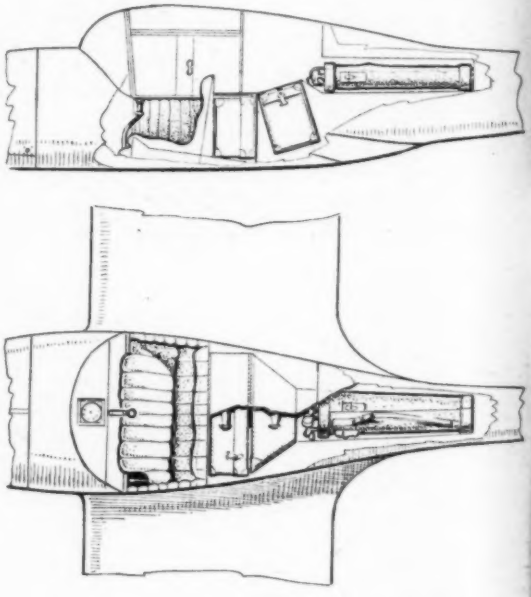
Luggage is evenly distributed between two compartments, one in the long tapering nose and the second behind the lavatory aft of the cabin.

The empennage of the Swan follows the latest twin-fin-and-rudder practice and the tailplane is of strikingly broad span. Another prominent characteristic of the machine is the pronounced dihedral on the main planes.

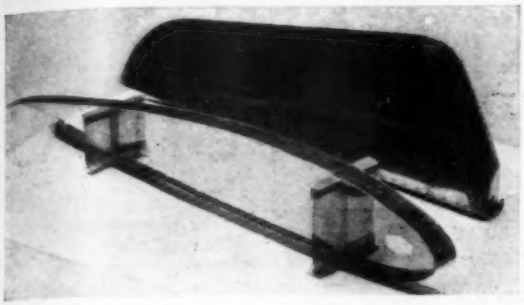
Cygnet Production

All being well the Swan should fly in about a year's time. Meanwhile Cygnet production is proceeding steadily, a batch of twenty of these intriguing little two-seaters having been ordered. All will be powered with the 130 h.p. Gipsy Major I and, embodying aerodynamic and structural refinements suggested during trials with the prototype, should be capable of 150 m.p.h. The upholstery will be by Abbey Coachwork. One of the more prominent alterations has been made in the seating arrangements; there is now a single bench-type seat and a central control column. If need be dual sticks can be easily arranged on the cross-shaft. There is space for two large, specially designed suit cases and accommodation for golf bags down the "tadpole" tail quite apart from other space behind the seat.

The screen (in two half-spheres with no flats—made of



The Cygnet accommodates pilot and passenger and has liberal stowage for luggage and sports gear. It will be seen that the seat now extends across the cabin.



A rib and elevator in Noral, which material is being extensively employed in the production Cygnets.

Plastilume-moulded acetate sheeting) and roof portion of the production machines will blend more smoothly with the general lines. A standard dash arrangement has been evolved; this has a central panel and two lockers. The panel is hinged at its base for inspection of the leads. Special instruments or a Sperry panel can be arranged on the pilot's side in place of the locker.

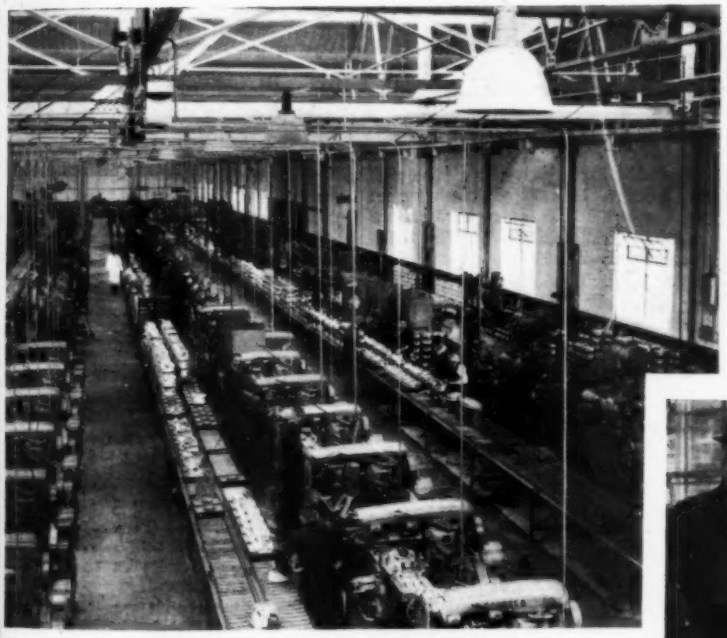
The latest Cygnet has its flaps in two portions, there being no central section as on the prototype. Mechanical operation is specified. Another change is the introduction of double the dihedral (now 10 deg.), making for better stability. The rudder and wheels will be larger than on the prototype.

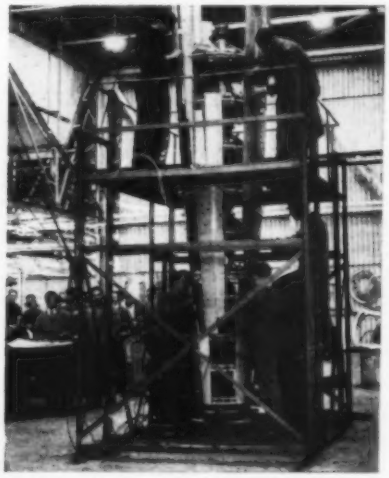
A South African trip has been arranged for the Cygnet demonstrator which should be finished in about three weeks.

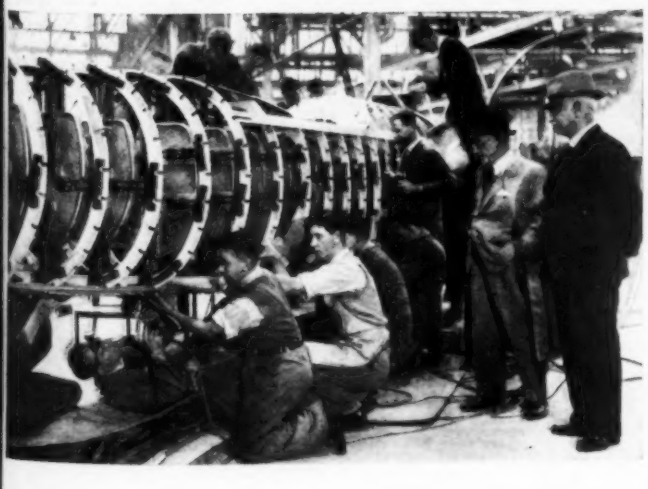
The manufacturers are highly enthusiastic about the results they have obtained with Noral NA57S strain-hardened aluminium alloy for structural parts and skin surfaces. This material, produced by the Northern Aluminium Co., Ltd., is claimed to possess high resistance against corrosion, to have adequate strength combined with ductility and to be comparatively cheap.

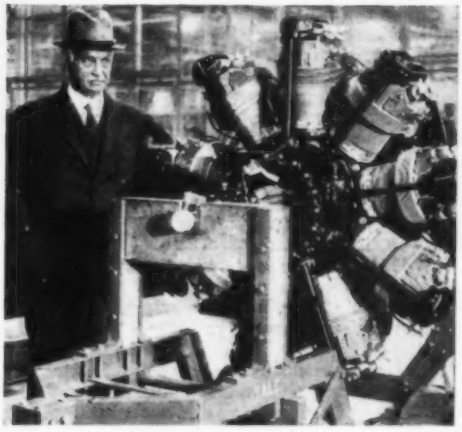
Apart from their work on the Cygnets and the Swan, C. W. Aircraft are taking in some substantial sub-contracts at their new works in Oxford Avenue, Trading Estate, Slough.

THE REASSURING SHADOW









If the photographer had chosen the same spots for his pictures a year ago his plates would have recorded the image, not of humming "shadow" factories, but of open fields. The mushroom growth of the "shadow" factories, however, is certainly not reflected in the quality of their products. The top left-hand view shows part of the Standard factory; the upper and lower right-hand views, respectively, are of a vertical fuselage jig in the Rover plant and Lord Austin with a Bristol Mercury built in his company's factory; and lower left, Lord Austin is watching a Fairey Battle fuselage take shape.

PRIVATE FLYING

Topics of the Day

Training . . .

ABOUT two years ago I spent an interesting half-hour in the cockpit of the Reid Aptitude Tester at Desford and proceeded to do everything quite well (footwork well above average) until somebody fired a klazon at me while doing "spins." Recovery was delayed for several seconds while I searched for a good reason for this remarkable disturbance, designed purely for the purpose of catching out more highly strung individuals.

The operation of the device is really quite simple. A series of coloured lights have to be put out without delay or dither by movements of the stick and rudder. The machine is not intended for training—though, presumably, practice would tend to improve the speed and accuracy of one's reactions—but merely to weed out those prospective pilots who are likely to be unfit for flying.

Since that time I have taken a rather greater interest in ground trainers and in the American Link Trainer particularly. This affair (the purposes and operation of which are described in considerable detail on pp. 416-419 of this issue) is still not designed to teach people to fly, but to teach them to fly by instrument and radio assistance alone—and without the expense of long period dual which must necessarily be carried out in a very fully equipped machine. One example, at least, has been over here for a considerable time, and everybody concerned with it at the Air Ministry appears to be very impressed.

Incidentally, the Danish Air Force, I believe, among others, have tried the experiment of training pilots *ab initio* under the hood and, according to reports, the results have been both interesting and successful. The other day I heard a story about a pupil who, without previous flying experience, was given a fifteen-hour course in the Link. He was then taken up in a real machine under the hood and continued to perform with unexpected skill. When his instructor told him to put down the hood his flying went all haywire and he was finally flown home in a state bordering on collapse. What about Pavlov's dogs now?

. . . On the Ground

SERIOUSLY, though, this Link Trainer, though designed solely for instrument-flying training, brings up the old question of whether it is possible to break the back of the *ab initio* flying business in an inexpensive way. It should be possible at least to teach the fundamentals and to save a few hours of dual action and reaction, and on the *manner* in which the controls of an aeroplane should be used to obtain the necessary effects.

Quite half of one's initial training really consists of learning not to over-correct and of practising combined control movements. Few pupils have much difficulty in judging landing height and altitude, and really reliable approach judgment does not, in any case, come in much less than fifty hours' flying.

Unfortunately, the type of ground trainer which would faithfully reproduce all the shades of load on the controls at different speeds, attitudes and throttle openings would probably cost as much as the real thing. The club or school might save a little money in insurance and normal running costs, and the question would merely be whether this saving would be lost again in the amount of additional genuine dual which might be required.

However, one or two Link Trainers might presently be available for transport training, and the budding "B" licence aspirant may yet be able to put some of his blind-flying training on this device. Certainly the ordinary course on an ordinary aeroplane only teaches the pupil the basic essentials of the work, which in transport flying includes so much more than a mere ability to fly by instrument over a predetermined series of tracks—difficult though that may be.

Mind Over Matter

BY way of a return to Pavlov's dogs, which responded in a remarkable way to various experiments in conditioning and reflex actions, I may say that a good many pilots seem to be able to fly blind in cloud quite happily without much more than a compass, an A.S.I. and a cross-level, yet, with all the instruments in the world, manage to do very badly under the hood.

My first instructor, on one day which was too rough for landings, gave me a little cloud-flying dual, lasting perhaps five minutes, without an instrument of any kind. I had what there were to myself in the rear cockpit, yet all the time he was telling me to "lift the right wing," "stop that turn to the left" or "climb more steeply." Needless to say, he was instructing on light and shade values in the cloudbank as well as on "feel," and he would probably have been as lost as any novice if he had been under a hood.

The whole thing is largely a matter of mental comfort. Because it doesn't matter whether the job is done properly or not, I have little difficulty in holding a set course and attitude while climbing through a layer of cloud for fun, yet when I am under a hood the A.S.I. leaps about, the compass needle can only be held within ten degrees of its correct position, and I am wet through with the concentration demanded. Just the difference between easy, almost careless, attention and the effect of a strong desire to put up a good show at all costs. In normal cloud flying I may be helped a little, and quite unconsciously, by the difference between the light above and below, but I never look out except for an occasional glance upwards to see if any faint blue tinge or brighter light suggests that the ice is about to be broken.

INDICATOR.

FROM the CLUBS and SCHOOLS

STRATHTAY

GALES during the week ended October 17 kept flying at Perth down to only 10 hours. The date of the annual ball has been changed from November 26 to January 14, 1938.

LONDON

The flying for last week amounted to 58 hr. 40 min. New members were Messrs. W. Ponting and W. E. Daniel

EDINBURGH

Last week was another good one for the Edinburgh Club with a number of flying visitors from Perth, Newcastle and Renfrew. There were three new members.

C.A.S.C.

High winds being the order of the day only 6 hr. 35 min. flying was done at Cambridge last Sunday. During the afternoon members attended a lecture on compass swinging.

NORTHAMPTON

The intense fog during the week restricted Club flying considerably. "A" licence tests were completed by Mr. E. H. L. Cooper. Tickets are now available for the annual Tramps' Party and Firework Display on November 5.

REDHILL

The flying for two weeks ending October 22 totalled 84 hr. 15 min. The Puss Moth has been to Paris and the Fox Moth to Nice. Messrs. Hipperson and Bailey have secured their "A" licences and Mr. Back has carried out his "B" licence night-flying test.

MARSHALL'S

The change-over to the new aerodrome was made on October 21. [See p. 430.—ED.] Flying for last week totalled 65 hr. 45 min. Messrs. Brown and Gabb passed their "A" licence tests. Three new members to the Club were Messrs. Hall, Sawyer and Hyde.

YAPTON

High winds were responsible for the low flying time at Yapton, which amounted to 20 hours. Mr. J. C. Howard completed "A" licence tests, and Messrs. C. W. Bourke and R. G. Hall joined with the intention of obtaining their "A" licences

BORDER

For the first three weeks of October a total of 2 hr. 50 min. was flown, and Messrs. P. Ruding-Bryan and T. T. Macan have passed their "A" licence tests. During the latter three days of last week flying was restricted by the widespread fog, although visibility was never below 500 yards.

HANWORTH

Inclement weather brought flying hours down to a minimum this week, 43 hours being logged. Mr. Jim Broadbent left on a record flight to Australia in his Leopard Moth on the 22nd. Mr. J. A. Chubb completed his "A" licence tests and three new members were welcomed to the Club.

YORKSHIRE

Nearly 19 hours represented the total flying for last week, fog prevailing on most days. A cross-country was made to Doncaster. The usual bonfire and firework display, to be followed by supper in the clubhouse, will be held on November 5. Mr. S. E. Brown passed his "A" licence tests.

HYDERABAD

As might be expected, the prevailing weather conditions during September were unfavourable to flying The flying recorded by the Hyderabad State Aero Club was 58 hr. 50 min., and the membership of the Club has reached 67. Mr. Hassim Ali and Lieut. Mohuiddin Ahmed made their first solo flights.

LANCASHIRE

The annual ball of the Lancashire Aero Club will be held at the Palace Hotel, Buxton, on November 26. Tickets are obtainable from the Secretary. In conjunction with this the Lancs and Cheshire Car Club are holding a car rally, starting from the Rising Sun, at Hazel Grove, open to all-comers.

COUNTY

The County Flying Club of Leicester have now put in something like 180 hours on their Taylor Cub, which has been flying for eight weeks The Club has seven "A" licences, while fourteen first solos have been made, and twelve more members are ready to be pushed off. A second Cub has just been ordered.

CINQUE PORTS

The big moment of the week was, of course, the landing of Miss Jean Batten at Lympne on her record-breaking flight from Australia, and members turned out in force to welcome her. Owing to the break in the weather flying hours dropped a little and totalled 55. Miss Mackinlay has obtained her "A" licence.

HERTS AND ESSEX

The annual dinner and dance will be held at the Park Lane Hotel on Thursday, December 2. Flying times have been severely handicapped by fog on two days, but a total of 104 hr. 41 min. was spent in the air. First solo flights were made by Miss R. M. Hughes and Mr. G. W. Foley. The Stinson Junior, Swallow and Moth have returned from their C. of A. overhauls.

SOUTHEND

The annual supper ball takes place to-morrow (October 29), at 8 p.m., at Garon's Banqueting Hall, Southend-on-Sea. Flying times for the week, in contrast to other reports, have shown a great improvement owing to slightly better weather conditions. "A" licence tests have been passed by Messrs. A. J. Villiers and W. A. R. Keddie. Pilots are concentrating on blind flying.

RAND

The Rand Flying Club's training operations at Potchefstroom started on October 1, while those at Klerksdorp were temporarily suspended. The monthly dance was held on October 13 and a "guest Sunday" was due to be held on October 24. Capt. Gray and Mr. Lundie resumed their duties after completing a refresher course at the C.F.S. A total of 323 hr. 14 min. flying was carried out during September at Germiston and at Benoni, Potchefstroom and Klerksdorp.

NOTTINGHAM

The Major Moths have now been replaced by Avro Cadets, and several cross-country flights were made when weather permitted. Only 14 hours were, however, spent in the air owing to unsympathetic flying weather. The competition for the Sir Thomas Shipstone Trophy was won by Mr. G. G. Thorpe, with Mr. M. Birkin as runner-up. A new member is Mr. J. K. Flower. A Guy Fawkes party and bonfire, followed by hot suppers, will be held at the clubhouse on November 5

JOHANNESBURG

On September 5 the Johannesburg Light Plane Club held a forced landing competition which was won by Mr. W. L. Grafton; Messrs. D. Dunn and G. Morton were placed second and third. A fortnight later nine Club machines visited Randfontein, and on September 24 another formation flew over Krugersdorp. All the attackers were shot down at Vereeniging on September 26 during a dawn patrol—an idea which is certainly spreading. A total of 500 hours were flown by the Club at Baragwanath during September.

BROOKLANDS

High winds and fog greatly hindered instruction during the week and the wind also caused a postponement of the cross-country competition for the Shipwright Trophy. It is hoped to fly this off next Sunday. Flying times were down to 51 hours. Table tennis is now very popular, and a match was played on Sunday against Bloomsbury House Club, the London club winning 11—5. Four of Mr. Robert Ashton's pupils sat for their Second Class Air Navigators' Certificates. The results are not, of course, yet known.

SCOTTISH

Bad weather conditions have held up flying at Renfrew during the past week, the total being 24 hours. A Bombing Competition was held on Sunday, the 17th instant, and this caused a good deal of amusement. Some of the bomb throwers would have blown their machines to pieces if the bombs had been real instead of bags of flour, for quite a number hit the trailing edge of the lower plane. The winner was Mr. J. Morton, the prize being a free ticket for the annual ball to be held at the Central Hotel, Glasgow, on November 19.

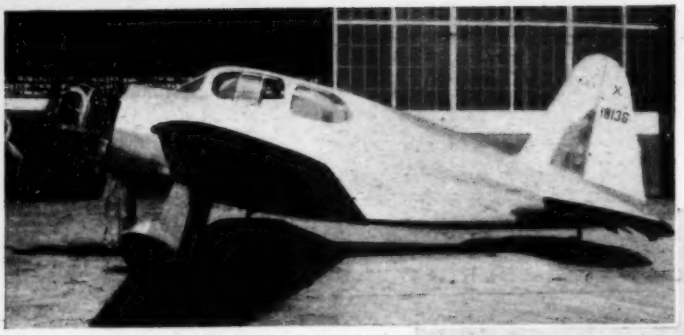
Indian Atlantic Attempt

BY way of helping to put India more firmly on the map in the field of human endeavour, Mr. G. P. Nair is to attempt a solo crossing of the Atlantic. He will fly the specially tanked Miles Hawk Major, with a range of about 3,000 miles, which was originally made to the order of Mr. J. H. Van and which has, until recently, been lying in the Phillips and Powis shops at Reading. Mr. Nair was due to leave Croydon on Saturday, but the weather conditions were not favourable.

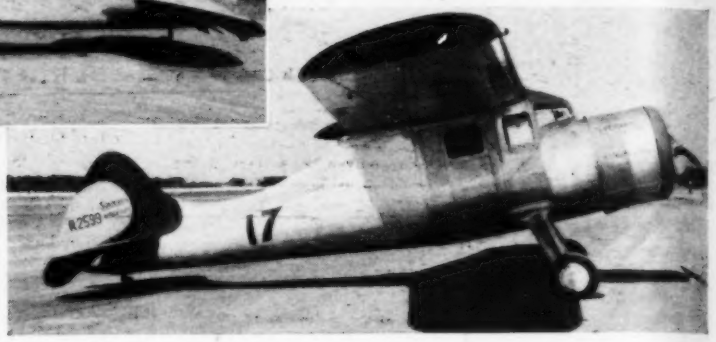
On Wednesday of last week a reception was held by his fellow-countrymen at the Caxton Hall, Westminster, when various representatives of Indian organisations over here wished him the best of luck. The chair was taken by Mr. M. S. Ramaswami, and one of the speakers was Mr. Frogley, of the Herts and Essex Club, where Mr. Nair has carried out some of his more recent "refresher" flying. Although we are not in favour of such a project—particularly now that *Caledonia* and *Cambria* have, with suitable equipment, made the crossing so often and with such comparative ease—we can but wish Mr. Nair success in his venture.

Private Flying

THE ALL-METAL TREND



(Left) An experimental, private-owner type, the PJC-1, which has recently carried out its test flights quite successfully on the comparatively small power of a Warner Super-Scarab.



(Right) Another experimental type of unorthodox layout, the Sundorph A-1, powered with a Jacobs L-5. This, like the PJC-1 above, is a stressed-skin job and is in the same class as the Beechcraft and Stinson. The Sundorph flew in the Bendix Trophy race, but apparently developed wing flutter and retired.

Three Months at Almaza

THE Misr Airwork Flying School, at Almaza, Cairo, continues to do good work. During the months of July, August and September, some fourteen "A" licences were obtained, and of the pilots concerned two, Messrs. Whitefoord and Hornung, obtained theirs in record time. The former soloed after 3 hr. 55 min. dual and was licensed after a total of 7 hr. 25 min., while the latter covered the whole itinerary in 9 hours' flying. Cross-country bathing and picnic trips have been particularly popular and the school has evolved the idea of providing portable tents and chairs which can be carried in the machines. Parties leave before the mid-day bumps and return in the cool of the evening. During three week-ends in August the entire school left for Ras el Bar, where the temperature was lower, and the work carried on as usual. In September Alexandria and Mersa Matruh, were the week-end centres, while night-flying instruction was given at Dekheila aerodrome.

Two new Tiger Moths arrived during July and were added to the fleet, which previously consisted of four Gipsy Moths, one Hornet Moth and a Leopard.

Practical Ideal

SINCE the Moss monoplane was originally described in *Flight* and later made its passing appearance at Hatfield and Hanworth at the time of the King's Cup race—for which it was not quite ready in official time—it has returned to its Chorley home for certain minor modifications and improvements. The machine, with slightly altered cowling, increased elevator movement (and possibly trimming tabs), complete instrument layout and "finished" upholstery, will be flying again before the end of the year, and a second version, with full dual and open cockpits arranged on Miles Mohawk lines, should be flying before next season.

Apparently this little Pobjoy-engined low-wing monoplane has given perfect satisfaction from the moment of its first flight, and the additional elevator movement is being provided as a luxury rather than because it is quite necessary. It will be remembered that the pilot and passenger sit tandem-wise, the former in front and almost directly over the leading edge so that his view is exceptionally good. When flown solo it was found that the tail could not always be put right down for the landing, though there was no tendency to nose over and the brakes could, in fact, be used hard almost immediately after the touch-down.

Any possible doubts about its take-off, controllable approach and slow landing were dispelled when we saw the little field from which the first and some later flights were made by Mr. W. H. Moss—the eldest of the five brothers (all pilots) concerned in the enterprise. The field is very small and rough, has a steep slope in two directions, and is partially surrounded by trees. It is, however, next door to the Moss paint and varnish works and appears to be the only possible field in the immediate vicinity. Needless to say, the more serious test work was carried out at Blackpool by either W. H. or R. L. Moss—this complying with "Indicator's" recent suggestion that all private-owner types should be test-flown by private owners. The brothers own a Cirrus III Moth which is normally housed at the works.

With a momentarily dying interest in such types it is pleasant to see progress with one more attempt to produce a practical and inexpensive ideal—though the brothers may eventually decide that the market does not warrant the effort and expense of production. That depends on the flying public's reactions when the finished machine is brought out and demonstrated. Certainly it seems to be a little too useful (the cruising speed is 120 m.p.h. and the landing speed about 40 m.p.h.) to become merely the product of a private owner's hobby in these days when the choice of machines is so limited.

Hillson Progress

IT was inevitable that confidence in the resurrected ultra-light aeroplane should only be built up slowly and that the firm which makes good in the end will be one with patience and a sound backing. F. Hills and Sons, the manufacturers of the British Praga, are in that happy position, and, after eighteen months of endeavour, are now beginning to see something for their efforts.

The company is primarily concerned with the large-scale manufacture of such things as window frames and, more recently (at their Trafford Park, Manchester, works), with the mass-production of plywood for the building and other trades. It was natural that they should enter the aircraft market, and, in addition to the manufacture of the Praga two-seater monoplane, they are interested in airscrew production under the Jablo patents.

By way of bringing the Praga more easily to the attention of the public, the company has started the Northern School of Aviation at Barton airport, and this school already has fifty flying pupils. Five Hillson Pragas are used, with three instructors, and a new building, comprising a hanger, offices and clubhouse, has been erected at Manchester's old airport.

The Straight Corporation, too, has ordered five machines for its string of clubs, and these are now almost ready to be delivered. They are fitted with Aeronca-J.A.P. engines, in place of Pragas, in order that the pilots training on them should be eligible for the subsidy, the conditions for which demand that British-made machines and engines should be used.

The Real Thing

"I Wanted Wings," by Beirne Lay; Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2; 10s. 6d.

FOR some reason or other the American novelist and short-story writer can usually manage to use all the technical material in his background—whether this is one of oil drilling, steel working, flying or anything else—to such advantage that both the layman and the expert are satisfied. In his foreword Mr. Beirne Lay says that the book is not for flying people; we disagree with him. The pilot will enjoy it even more than the non-pilot, since it breathes reality, and he will complain of only one thing—that a book dealing with American Army flying experiences should have, on its dust cover, a picture of an A.W. Atlas.

Mr. Lay obtained what we should call a short-service commission in the Army air service and he flew everything from Keystone bombers to Curtiss single-seat pursuit-ships.

WHITE HORSES OF WILTSHIRE

Five aerial views of unmistakable Wiltshire landmarks that are good friends to the denizens of Reserve schools and other such establishments in that pleasant quarter of England. The photographs may also serve as a caution to any pilots from distant parts who are under the impression that the handsome creature on Cherhill Down, near the Bristol Reserve School at Yatesbury, is Wiltshire's only equestrian landmark. Reading across from left to right, the horses shown are one mile N. E. of Alton Priors ; on Cherhill Down, half-a-mile S. E. of Cherhill and on the opposite side of the Bath Road to the Yatesbury School ; on Hackpen Hill, one and-a-half miles E. of Winterbourne Bassett ; half-a-mile S. W. of Marlborough ; and on Westbury Down, two miles N. E. of Westbury

Furthermore, he flew the mail during the period when Congress decided that the civil contracts were all wrong, and gives us some idea of the difficulties involved and of the reasons why there were so many fatal crashes.

Primarily, the book is descriptive, and few, if any, authors have succeeded so adequately in conveying, with all the wealth of American vernacular, the *real* impressions of flying, whether lumbering from A to B by night in a slow bomber, or aero batting "with 450 h.p. in your lap and a feather in your back" between 18,000 and 1,700 feet. We can even forgive Mr. Lay a very slight leaning towards the melodramatic and exaggerative because his descriptions are otherwise so magnificent. As for vernacular, there is a glossary of flying slang at the end, with much useful information for the American who wants to start flying.

Whether Americans *will* want to start flying (in the U.S. Army Air Corps, anyway) after reading Mr. Lay's books, strikes one as a matter for some doubt. Even to youths hardened-off in American universities, the "hazing" (since ameliorated) of new flight cadets must have been a nightmarish ordeal. "Snap into it, Mister! At the double, Mister! . . . a dodo is only allowed three answers, Mister—Yes, sir, No, sir, and No excuse, sir." Thus the senior cadets who were his slave-masters for the first six service months.

Most interesting was his discovery that the effect of describing his emotions during thirty-minutes' aerobatics in a pursuit-ship (for *Harper's Magazine*) was to "rip away his defence mechanism against fear of falling and speed" and to make him afraid. Flying back by night after delivering the manuscript, he was worried by a thousand things and he handled his P-6 mechanically rather than by feel. Only after the engine had cut at 7,000 feet because of a vapour lock and he found that he had instinctively switched tanks did he realise that habit and experience were greater than imagination or fear. Which explains, perhaps, why pilots are generally tongue-tied about their experiences ("The wings came off, so I bailed out") and why there are such things as "off" days.

Aeronautical Corporation's Future

AT the recent meeting of the Aeronautical Corporation of Great Britain, Ltd., it was announced that negotiations were taking place with a view to saving the company and re-establishing it on a new and sound basis. These negotiations have now been accomplished, and the directors have formulated a scheme for the reorganisation of the company's capital. An extraordinary general meeting will be held on November 2 to consider their proposals.

THE FASTEST HEINKEL

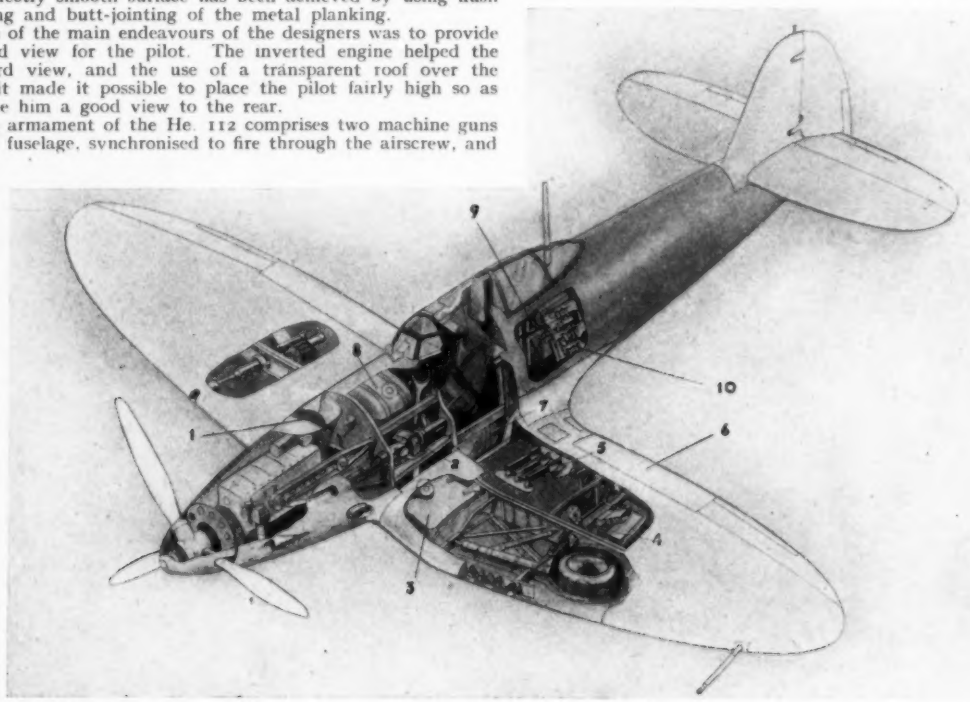
Two "Cannons" and Two Machine Guns on Heinkel He. 112 Fighter : Comparatively Low Power : 310 m.p.h.

THE He. 112 fighter shown at Milan and referred to in *Flight's* report (October 7), is the fastest aeroplane hitherto produced by the Heinkel Flugzeugwerke of Rostock, Germany. Fitted with a Junkers Jumo 210 Ea water-cooled engine which develops 660 b.h.p. at 12,800ft., the machine is claimed to have attained a maximum speed of 310 m.p.h., although the guaranteed speed is 300 m.p.h. The makers point out that the speed is not the result of crowding on power, but has been achieved by careful aerodynamic design and all possible refinements in the structure. A perfectly smooth surface has been achieved by using flush riveting and butt-jointing of the metal planking.

One of the main endeavours of the designers was to provide a good view for the pilot. The inverted engine helped the forward view, and the use of a transparent roof over the cockpit made it possible to place the pilot fairly high so as to give him a good view to the rear.

The armament of the He. 112 comprises two machine guns in the fuselage, synchronised to fire through the airscrew, and two "cannons" placed in the wings. In addition, the machine carries six 20 lb. bombs in the wings. The location of the armament and other equipment is shown in the accompanying illustration.

With a tare weight of 3,520 lb. the He. 112 carries a disposable load of 1,385 lb., so that the loaded weight is 4,905 lb. In addition to the armament mentioned, the machine has tankage sufficient for a range of 685 miles at a cruising speed of 276 m.p.h. The climb to 3,300 ft. takes 1.2 minutes and the service ceiling is 26,200 ft.



A part-sectional view, by a German artist, of the Heinkel He. 112. Some outstanding features include: (1) Air intake; (2) port machine gun; (3) fuel tank; (4) Oerlikon "cannon"; (5) 10 kg. fragmentation bombs; (6) flap; (7) fuel tank; (8) oil tank; (9) radio; (10) pneumatic gun-operating gear.

Forthcoming Events

November 2. R.Ae.S. Students' Section Lecture: "Light Alloy Castings and Stampings" by Mr. W. C. Devereux. R.Ae.S. Library, 7 p.m.

November 3. R.Ae.S. Weybridge Branch Lecture by Flt. Lt. J. W. Summers. Vickers Senior Staff Canteen, 6.15 p.m.

November 4. R.Ae.S. Lecture*: "Problems of High-Speed Flight as Affected by Compressibility," by Mr. C. N. H. Lock.

November 5. R.Ae.S. Students Section: Informal Supper.

November 12. Norfolk and Norwich Aero Club: Annual Ball.

November 12. R.Ae.S. Coventry Branch Lecture (with Coventry Engineering Society): "C.-I. Aero Engines," by Mr. A. Swan, Technical College Theatre.

November 16. Institute of Transport: Brancker Memorial Lecture: "Civil Aviation as a World Force," by Lord Sempill. Institution of Electrical Engineers, 6 p.m.

November 17. R.Ae.S. Weybridge Branch Lecture: "Light Alloy Castings and Stampings for Aeronautical Purposes," by Mr. W. C. Devereux, Vickers Senior Staff Canteen, 6.15 p.m.

November 18. R.Ae.S. Lecture*: "The Take-off Problem" by Mr. H. F. Vessey.

November 25. C.A.S.C.: Dance, First Avenue Restaurant, London W.C.1.

November 25. R.Ae.S. Coventry Branch Lecture: "Clouds," by Dr. R. C. Sutcliffe. Liberal Club, Union Street, 8.15 p.m.

December 1. R.Ae.S. Weybridge Branch Lecture: "Large Aeroplanes," by Dr. H. Roxbee-Cox. Vickers Senior Staff Canteen, 6.15 p.m.

December 2. R.Ae.S. Lecture*: "Wing Surface Controls with Reference to Possible Developments in Flying Technique," by Ft. Lt. H. P. Fraser.

December 7. Colleges of Automobile and Aeronautical Engineering: Annual Dinner and Dance, Grosvenor House, London.

December 8. R.U.S.I. Lecture: "Balloon Aprons," by Air Comdre. J. G. Hearson, Royal United Service Institution, 3 p.m.

December 10. Strathtay Aero Club: Annual Ball, Salutation Hotel, Perth.

December 15. R.Ae.S. Weybridge Branch Lecture: "Anodic Treatment," by Mr. J. Donaldson Craig. Vickers Senior Staff Canteen, 6.15 p.m.

December 16. R.Ae.S. Lecture*: "Development of Sailplanes," by Sqn. Ldr. G. M. Buxton.

December 17. London Aeroplane Club Dinner and Dance, Park Lane Hotel, London.

1938.

January 5. R.U.S.I. Lecture: "The Training of a Royal Air Force Pilot," by Air Vice-Marshal L. A. Pattinson. Royal United Service Institution, 3 p.m.

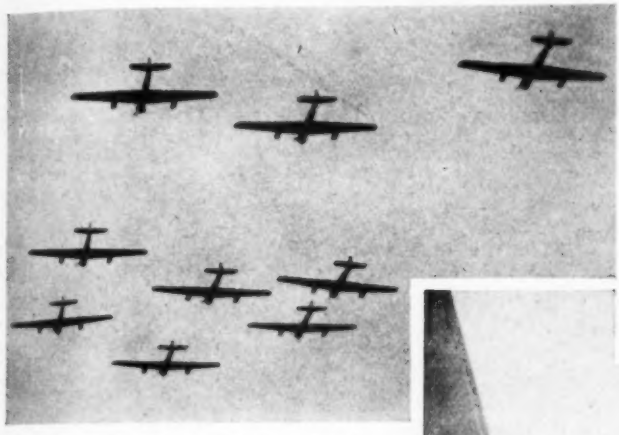
January 13. R.Ae.S. Lecture*: "Radio as a Direct Aid to Landing Approach," by Sqn. Ldr. R. S. Blucke.

January 26. R.U.S.I. Lecture: "Imperial Air Routes," by Lieut.-Col. H. Burchall, Royal United Service Institution, 3 p.m.

* All these lectures take place at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, beginning at 6.30 p.m.

OUR GERMAN GUESTS

General Milch and Other Distinguished Officers Inspect the Newest Equipment of the R.A.F.



(Above) A fly-past at Mildenhall, for the benefit of the guests, by a squadron of Vickers Wellesleys with their external "egg-boxes."

(Top, right) General Milch, at Mildenhall, watches a demonstration by a gunner in the rear cockpits of a Wellesley and (right) a Bristol Blenheim.

(Below) More armament: General Milch and Air Chief Marshal Sir Edgar Ludlow-Hewitt lead the party past the tail turret of an A. W. Whitley.

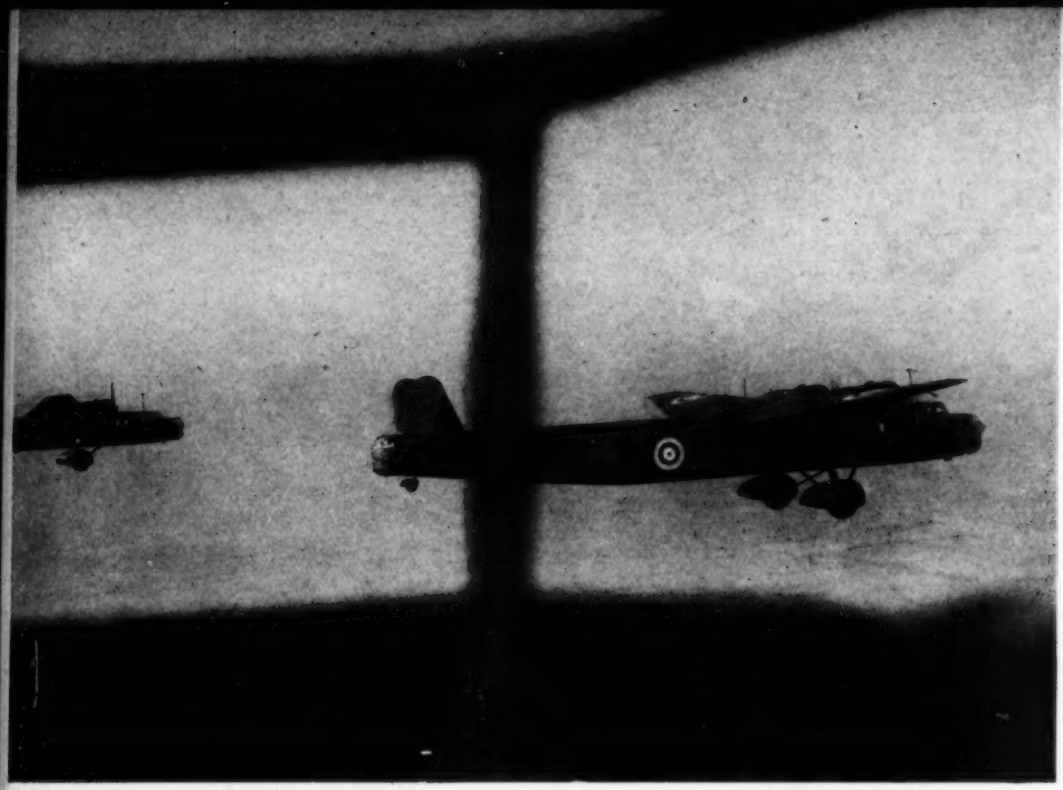
MILDENHALL, in three years, has had more publicity than the average R.A.F. station is likely to get in a lifetime. In October, 1934, it was the chilly, barren scene of the start of the England-Australia Race; on July 6, 1935, King George V inspected units of the R.A.F. on its broad, green surface, which by that time had come to know the touch of heavy bombers; it has been invaded by thousands on Empire Air Day; and on Tuesday of last week the aerodrome buildings, representative items of Service equipment, and a number of new squadrons were exhibited and demonstrated before German Air Force officers visiting this country as guests of the Air Council.

The party, which, as already recorded in *Flight*, arrived at Croydon last Sunday week in a special Heinkel He.111 (incidentally, with a pair of the new Daimler Benz inverted vees) was headed by General der Flieger Staatssekretar Milch, German Secretary of State for Air, and included Generalleutnant Stumpff, Chief of the Air Staff, and Generalmajor Ernst Udet. Earlier in the week the party had been presented to H.M. the King and had visited the Army Co-operation Units at Odiham.

General Milch, born in 1892, has probably done more for German civil flying than on the service side. He joined the board of directors of the Deutsche Lufthansa in 1926, and may be remembered as a visitor to the R.A.F. Display and Olympia show in 1929. Four years ago he was appointed General Goering's representative in air matters with the title of Staatssekretar, which position he still holds. He came to the S.B.A.C. display last year. The Air Ministry explains that General Milch's position is more nearly equivalent to that of Under-Secretary of State for Air in this country, General Goering himself being "Air Minister" as well as Chief of the Air Force.

Generalleutnant Stumpff, born 1889, had a very distinguished career in the infantry, on the General Staff and at the War Ministry until 1933, when he was transferred to the Air Ministry. His appointment corresponds to that of Chief of the Air Staff in the R.A.F. General Stumpff attended the Coronation as the German Air Force delegate.

Generalmajor Ernst Udet, Director of the Technical Department, was born in 1896, and was credited with sixty-two aerial victories during the war, in recognition of which he received the decoration *Pour le Merite*, the highest German honour. He founded the B.F.W. concern but is no longer interested in it, being placed in charge of



(Left) Going on parade : A *Flight* photograph taken from one of the units of a Squadron of Harrows on the way to Mildenhall.

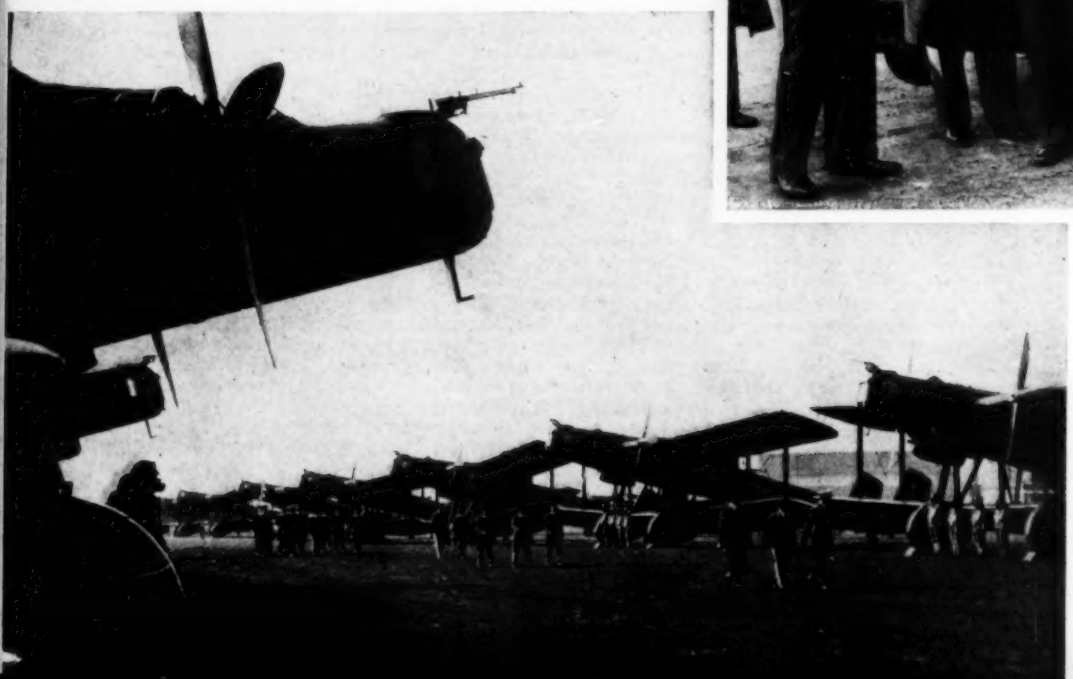
(Below) In civilian dress : The arrival of our German guests at Croydon at the beginning of the week. General Milch is being welcomed by A.V.-M. R. E. C. Peirse. General Wenninger, German air attaché, is in front of the cabin door of the Heinkel He. 111.

the Technical Department at the Air Ministry on the formation of the German Air Force.

Accompanying the aforementioned officers were Major Kreipe, Major Nielsen and Oberstleutnant Polte.

It had been planned that the party, which was received by Air Chief Marshal Sir Edgar R. Ludlow-Hewitt, A.O.C. in C., Bomber Command, and his staff officers, and by A.V.-M. P. H. L. Playfair and Air Comdre. D. C. S. Evill, should fly from Hendon in the Air Council's new D.H.86B. Conditions, however, were such that the flight was deemed inadvisable, so the trip was made by train and car.

A "guard of honour" was formed by the Heyfords of Nos. 99 and 149 (Bomber) Squadrons which are stationed at Mildenhall. Their crews stoically "stood to" in all their trappings for what must have seemed a very long time indeed. Behind the Heyford ranks were paraded a Blenheim medium bomber (1,680 h.p., 280 m.p.h., 1,000 miles), a Harrow heavy bomber (1,830 h.p., 190 m.p.h., 1,250-1,840 miles), a Vickers Wellesley medium bomber or general-purpose machine (915 h.p., 202.5 m.p.h., 1,325-2,270 miles (approx.)), an Armstrong Whitworth Whitley I (1,610 h.p., 192 m.p.h., 1,250-1,600 miles), and a Fairey



(Left) Not-so-new equipment : the visitors pass between the ranks of trusty Heyfords, each machine with its crew, in full flying kit, standing to attention.

Battle medium bomber (1,030 h.p., 257 m.p.h., 1,000 miles). Our visitors, so far as could be gathered, were shown and told anything they wished, and naturally were not a little intrigued by the power-driven gun turrets on the Harrow and Blenheim. The Harrow, incidentally, had all five guns mounted, and the other machines seemed to be equipped with the majority of their military load.

During the inspection the following units flew over at something like 1,000ft. and fairly high speed: One squadron of Wellesleys (with external bomb-carriers in position), two squadrons of Battles, two more of Harrows, one complete Blenheim squadron, and, later, six additional Bienheims. It had been planned to send two squadrons each of Battles, Blenheims, Harrows, Wellesleys and Whitleys, but the remaining machines were unable to get through.

Subsequently the mission inspected the aerodrome buildings, items of ground equipment, a group of armed transports, armament and photographic gear, and were given a demonstration of extinguishing a "mock-up" fire by one of the new fire tenders. The visit concluded with luncheon in a room in the officers' mess. The table was decorated in the Nazi colours.

On the next day, Wednesday, the party visited further R.A.F. stations and aircraft factories, and in the evening they were the guests of the Air Council at a cocktail party at the Carlton Hotel, London. All the members of the Air Council were present, and the guests were received by Lord Swinton. In addition to members of the Air Council, many of the directorates of the Air Ministry were also represented, and of former Chiefs of the Air Staff one noticed Lord Trenchard, Sir John Salmond, and Sir Edward Ellington (the latter is now Inspector-General of the R.A.F.).

The German visitors were, at that time, only half-way through their programme, but they had obviously seen much to interest them and were finding the comparison between the British and German air forces very instructive. It was impossible not to notice the racial similarity between these German aviation people and our own. Unless one stood within earshot of one of the many small groups into which the party divided, it was difficult, not to say impossible, to be at all certain which were German and which British. When the British mission visited German air force centres, in January last, the members all felt that they knew, understood and respected their German hosts. It is permissible to hope and indeed to believe that the German party under the leadership of General Milch returned to Germany with the same feeling.

To the "Shadow" Factories

The return was not made until Monday morning, although the official programme ended on Saturday, the party having in the meantime visited several "shadow" factories in the Midlands, and also Cranwell and Halton.

General Milch, in a speech on Saturday, said he had been chiefly impressed by two main points—the spirit of the airmen at the stations which the party had visited, and the great strides made recently in the British aircraft industry, particularly the "shadow" factories. He would have a splendid report for General Goering, the Air Minister, on every phase of their visit; and he expressed the party's gratitude not only to Lord Swinton, officials of the Air Ministry, and the officers of the R.A.F., but also to the Press and the public for the courtesy and kindness with which the visitors had everywhere been received.

During the week-end General Milch, Lt-Gen. Stumpff and Maj.-Gen. Udet were the guests of Lt.-Col. A. J. Muirhead, M.P., Under-Secretary for Air, at Haseley Court, Oxford.

BRIG. GEN. LEWIN'S RESCUE

FLIGHT is happy to place on record the fact that Brig.-Gen. A. C. Lewin, veteran private owner of a Miles Whitney Straight and runner-up in this year's King's Cup Race, is now safely back in civilisation after an adventure which, by all the laws of fate, might easily have ended far otherwise. And even more praiseworthy than the General's fortitude in a situation that might have broken the spirit of a lesser man was the patient courage of Mrs. Lewin, who, following a forced-landing crash, shared his ordeal of ten days' exposure on a tiny, mosquito-infested island in a Nile swamp.

Brig.-Gen. Lewin—who is 63 years of age—was returning with Mrs. Lewin in the Whitney Straight to their home in Kenya after his fine effort in the King's Cup. According to his exclusive message to *The Daily Telegraph and Morning Post*, the trouble arose through their overshooting Malakal, chiefly through a compass error, together with the breakage of their time-of-flight clock. Consequently they found themselves lost over the notorious Sudd swamps—an area as large as that of England—with a rapidly dwindling fuel supply.

Ten-day Ordeal

There was nothing for it but to put down, and, choosing a spot where some trees indicated an island in the sea of eight-foot reeds and water, the General attempted a landing. Entangling its wheels in the grass, the Straight nosed over into mud and water. The pilot had to fight his way out and then extricate his wife.

Though cut, bruised and shaken, neither was seriously hurt, and they sat down to consider their resources, which amounted to a gallon of water and a packet of sandwiches.

That night they spent in the wrecked aircraft, a prey to swarms of mosquitos and, after daybreak, flies. During the next day the General searched in vain for some avenue of escape while his wife saved a mosquito net into a sleeping bag, which allowed them a restful night. The next (the third) day they ate their last food, and—to use General Lewin's own characteristically matter-of-fact words—"Kites and vultures began to flock around us. I thought it premature, as I hoped we would last at least ten days unless we fell ill."

On the fourth day, when they were reduced to drinking the slimy green water of the swamp, they were sighted by the Empire flying boat *Cassiopeia* (Capt. Caspareuthus), which dropped food supplies and then put about for Malakal, where it spent the night, while No. 47 Squadron of the R.A.F., under the direction of Mr. Macphail, Acting Governor at Malakal, made ready to leave at dawn. Capt. Caspareuthus, by a fine piece of navigation, and finally aided by mirror signals from the castaways, then led the eight Service machines to the spot, where they dropped supplies which included food, water, blankets, medical stores, a marker flag, and a message picking-up apparatus of the kind familiar to all who have watched Army Co-operation exercises. This apparatus enabled the Lewins to send back a communication—incidentally a most generously worded one expressing their gratitude and the hope that no ill had befallen any of the searchers.

Meanwhile, Mr. Marwood, District Commissioner at Bor, ordered the police at Kanger, a village twenty miles distant from the Lewins, to send out a search party. These natives were driven back by rain and hunger, and a stronger party was then organised. Fighting their way through the swamp for four days, and guided by aircraft, the party eventually reached the castaways, on the tenth day after the crash. The dispatch of these search parties was organised by telephone from 150 miles away—the distance of the nearest white man.

The return to civilisation was another long battle with the grim terrain, but General Lewin and his wife withstood it wonderfully, and were soon in good health and spirits after a rest at Malakal.

The story is one which will go down in aviation history as reflecting the greatest credit on all concerned.

Prof. Hunsaker Looks In

SO many kindnesses have been shown to British visitors to the United States that it is a great pleasure for British aviation circles to have an opportunity to reciprocate. Such an opportunity occurred this week when Professor J. C. Hunsaker, of the Massachusetts Institute of Technology, paid an all-too-brief visit to England. At a small informal dinner given at the Royal Aero Club by the Royal Aeronautical Society last Monday, Professor Hunsaker met many of his old friends, and recalled that he began his aeronautical training at Teddington, in the N.P.L. Aerodynamics Department.

The Atlantic route problems were discussed, and it was jestingly decided that a body be established for the pooling of all information and experience held by Great Britain and America. *Flight* was particularly glad to renew a very old acquaintance with Professor Hunsaker, whose translation of Eiffel's first book is one of the Editor's treasured possessions.

COMMERCIAL AVIATION

HONOLULU BOUND: Such a prosaic excrescence as the wing-tip float of a Sikorsky S.43, used on the Hawaiian inter-island service, assumes a dramatic aspect against this Pacific background.

THE WEEK AT CROYDON

Passengers—Very Young and Otherwise : Private Air Transport : A Matter of Safety : Wanted—An Information Bureau : Cheapening the Airport

ONE of last week's most interesting passengers was Miss Monica, three-weeks-old daughter of Mr. and Mrs. Hans Ostelius. The proud father, who is the representative of Swedish Air Lines in London, met Mrs. Ostelius and daughter on their arrival from Holland.

Amongst other well-known travellers were H.R.H. Prince Axel of Denmark to Sweden, Sir Philip Sassoon to Prague, and Herr Walter Neusel, still bearing the scars of battle, to Berlin. From Amsterdam came Mr. W. B. Duhr, chief barman of the Amstel Hotel, Amsterdam, who to my certain knowledge shakes a very pretty cocktail. He was over here to display his art and produce his own special secret galvaniser at an Anglo-Dutch cocktail party. There is no end to the variety of professions one meets at an airport. One of last week's travellers was Mr. J. Dellaert, for example, over here to discuss airport layout and design with British colleagues. He is one of Europe's most experienced airport officials—Municipal Airport Officer for many years at Schiphol, Amsterdam, one of the best designed and most efficiently operated of European airports.

Capt. O. P. Jones, who celebrated his thirty-ninth birthday last week, also had cause to drink his own health on the score of twenty years' flying, for he made his first flight on his nineteenth birthday in 1917. It is interesting that Major Greer, one of the very first Chief Aerodrome Officers at Croydon, was his instructor. O. P. Jones has one million, three hundred and forty-thousand miles to his credit—or thirteen thousand, three hundred and ninety-five flying hours.

The Bata Shoe Company is nothing if not up to the minute. I believe the company has, at Zlin, an establishment of staff aeroplanes, pilots, Marconists, engineers and all accessories, which would do credit to a small air transport company. One of the company's Lockheed Electras was at Croydon last week and I noticed that the pilot was as smartly turned out in uniform as any one of his regular airline confrères.

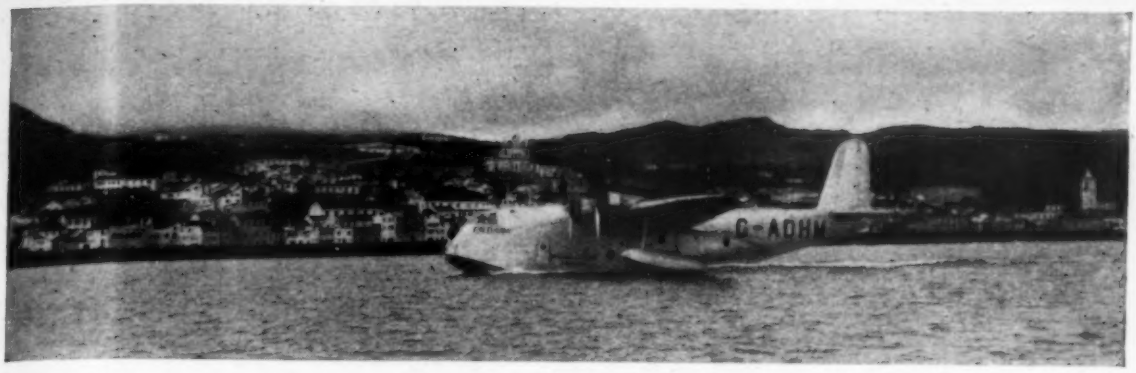
I saw a queer leading article last week in a newspaper which prides itself on being well informed on air matters. Fog was the text, and it is interesting to see that at last what *Flight* has been preaching for years is clearly recognised, viz.: that air transport is vastly superior to surface transport in many types of weather. After recording shipping and rail muddle and confusion on the roads the writer says "even the air liners cannot get through," but he continues, "the public will be interested to know why, for the Continental pilots are flying blind as often as need be." The public probably *does* understand the situation, and it is the leader-writer who would seem to need enlightenment. Possibly he has swum fairly comfortably in a sea with huge rollers, but has found it quite impossible to come ashore amongst the rocks where those same rollers are breaking. To fly blind as often and as much as need be is a very different matter to making contact with Mother Earth at a fog-bound terminal. It can be done—but not with safety.

Visitors to Le Bourget tell me that there is a conveniently placed kiosk at the airport where all sorts of interesting information can be obtained. It is called the "Syndicate d'Initiative de Paris et de la Seine." A courteous official, having the gift of tongues, gives information about hotels, *pensions* (but not those on which civil servants wax so fat when they retire), sight-seeing and the gay life in general. Probably some information about air services and the airport itself is also to be obtained. Heaven forbid that I should suggest anything so startling and unusual to the authorities of Croydon Airport as a "Syndicate of Initiative," but it is really about time that this airport came into line with others in Europe in the way of giving much-needed information and assistance to travellers and visitors and in announcing by loud speaker the arrival and departure of services and other items of information. But only a neutral body can undertake such a job.

One hesitates to mention initiative to the authorities just now, for there is such a thing as "initiative run mad." At the moment there seems to be too much of this sort of thing, for advertising has now invaded the main hall.

This lust for lucre or passion for pelf blandly ignores the "gentlemen's agreement," whereby tenants have always been led to suppose that their more than Bond Street rentals would secure for them that first-class impression the authorities themselves sought to give the place when they insisted on parquet floors, oak panelling and the rest. "The end," these amateur wizard financiers of the Treasury will say, "justifies the (somewhat sordid) means, for the taxpayer will annually be saved a paltry hundred pounds or so." The taxpayer will, of course, know all about it and be wildly enthusiastic, remembering the thousands which these same clever fellows waste in other ways.

A. VIATOR.



ATLANTIC SURVEY: *Caledonia* taxies to her moorings at Horta, Azores, after her recent survey trip in command of Captain Powell.

More Menaces

THE *Notice to Airmen* (No. 227) giving a list of the centres, twelve in all, in various parts of the country where target towing may be carried out is not quite so horrifying as it appears at first sight. Only four of the areas are within the vicinity of the tracks of regular air services, and it is clearly stated that the targets will only be towed at heights where the horizontal visibility is more than five miles. However, the tow-line may be as long as 1,000ft., and it behoves all pilots to keep their eyes open in these areas.

Meanwhile, it appears that both Highland Airways and North-Eastern Airways are lodging protests with the Air Ministry against the detours which their pilots are compelled to make at certain points on the main routes because of Air Force and Naval exercises. Through compulsory deviations at Cardington to avoid the balloon barrage area and over the Firth of Forth, North-Eastern machines, for instance, are tending to drop behind schedule on the London-Perth route.

Australian Additions

QUITE apart from Qantas' part in the new trunk service plans, things are nowadays moving along very rapidly in Australia. During the last few months Australian National Airways have increased the number of their services and are co-operating with Airlines of Australia on an Adelaide-Melbourne-Sydney-Brisbane run, using D.C.2s; Guinea Airways have started Adelaide-Darwin and Adelaide-Sydney runs, using Electras, and Ansett Airways, also with Electras, are flying a Melbourne-Mildura-Broken Hill service.

There are also rumours that a really large new company, backed by American interests, is to start nightly inter-capital mail and freight services, using either D.C.3s or Lockheed 14s, and to run a special school for the training of its personnel in its work. Officially, however, nobody appears to know very much about it, though the Federal Government has been intending for more than a year to send all first-class mail by air.

Lorenz ultra-short-wave approach equipment has now been experimentally installed at Essendon, Melbourne, and the whole radio system is being reorganised. Mr. A. R. McComb, the director of ground services, has been over here in connection with such matters.

British Airways Resignations

FOLLOWING so shortly after the resignation of Sir Percy Mackinnon from the board of British Airways, it is with special regret that we record the fact that Mr. F. W. Jones and Mr. T. R. Bryans have also severed their connection with this company. No official statement has been issued by British Airways, and the three directors concerned very properly remain silent on the matter.

It will be remembered that Sir Percy was chairman of British Continental Airways (a very go-ahead concern which was later fused with British Airways), while Mr. Jones was the managing director and Mr. Bryans a very active and interested member of the board. Mr. Jones, whose connection with aviation and general insurance is well known, has been in charge of West African and South American projects both before and after the amalgamation, and his place will not be easily filled. All three have shown an enthusiasm for air transport, with all its problems and setbacks, which, unfortunately, is not always to be found in high places. Mr. Farey Jones remains, of course, the chairman and managing director of Rollason Aircraft Services, of which Mr. Bryans is also a director.

The "Lieutenant" Out Again

AT 7.35 a.m. on Monday the six-engined Latécoère boat, the *Lieutenant de Vaisseau Paris*, left Kenitra, Morocco, on an attempt on the long-distance flying-boat record. This is at present held by America with a distance of about 3,280 miles. The *Lieutenant* is flying to West Africa and thence to Natal and down the South American coast. It will be remembered that the arrangements for North Atlantic trails by this boat were recently countermanded on the score of effective range against possible head winds.

Paris–Buenos Aires

AIR FRANCE is to make a special demonstration flight with the four-engined Farman 2231, which took part in the Istres-Damascus-Paris race. Codos will be the pilot, and the flight will be from Paris to Buenos Aires—about 8,000 miles—with only two stops at Dakar (West Africa) and Natal (Brazil).

The Farman 2231, it will be remembered, has been specially built for the Air France-Transatlantique Company, and was to make trial flights across the North Atlantic, stopping at the Azores. Pending the necessary facilities from the Portuguese Government for French machines to use the Azores as a stopping place, the North Atlantic trials have been suspended. The flight from Paris to Buenos Aires will be a speed demonstration and should have valuable propaganda value for Air France and their South American mail service in the capitals of that Continent.

The Air Ministry Takes Over

AMONG the recommendations of the Maybury Committee was that of the formation of a comprehensive air traffic control organisation adequate for the safety and regularity of air services, this to be provided, maintained and operated by the Government. For some time a training school for control officers has been in action in London, under Mr. J. J. Jeffs' supervision, and a course of practical instruction is also given at one of the two existing Air Ministry control stations at Croydon and Heston Airports.

Manchester has now been selected as the first provincial air traffic control station to be manned by Air Ministry staff, who started their duties on October 21. A similar station will shortly be established at Portsmouth, the opening of which has been provisionally scheduled for November 1. In selecting the radio communication areas to be the first to receive these fully qualified Air Ministry Control Officers, the deciding factors were density and frequency of air transport movements within these areas. Analysis of traffic conditions has shown that, after Croydon and Heston (which are already under Air Ministry control) the greatest densities of traffic are in the Manchester and Portsmouth areas, and it was accordingly decided that these areas should be the first to receive them.

It may be remembered that Manchester (Barton) Airport was opened as long ago as April, 1930. Three years later a radio station was installed, but traffic in the North, Midlands, and notably over the Irish Sea, increased to such an extent that a second radio channel had to be installed early this year, mainly for the use of Isle of Man traffic. The Portsmouth City Airport was opened in 1931, and the radio station was installed in 1934. In addition to mainland and Channel Islands services, Portsmouth has to look after the Empire flying boats which are at present using Southampton Water as a base.

Commercial Aviation

A Finnish Aero Show

AN international aero show is to be held in May, 1938, at the Mässhallen, Helsingfors. Popularly known as S.I.L.I. (an abbreviation of the long Finnish title, the Second International Aero Show of the Finnish Air Defence Federation), the show will be held under the patronage of H.E. Kyösti Kallio, President of the Finnish Republic.

Weather Broadcasts

THAT extremely useful weather broadcast from Borough Hill, Northamptonshire, has again been slightly revised, and the new time-table is given in *Notice to Airmen* No. 232.

Normal reports will now be dictated once only, while the forecasts and warnings will, as before, be repeated. During the winter the first series of reports will be given at 7.15 a.m. and the first forecast at 8.45 a.m. The frequency is 245 kc/s (1,224 m.).

Something New in Aerial Position

A SOMEWHAT radical departure from the conventional radio aerial installation is being adopted by Northwest Airlines for their new Lockheed 14s. To take the place of the usual metal nose a plexiglass cone has been designed to house the loop for the radio compass. Tests appear to have shown that the loop has a maximum effectiveness in eliminating "high-speed" static, while this nose section does not absorb signal strength as in the case of a metal covering. Needless to say, the new system also reduces drag.

Making Use of It

AIR transport is proving more and more useful to commercial houses. Messrs. Debenham and Freebody recently chartered an Air Commerce Rapide to fly six of their buyers on a tour to Leipzig, Berlin and Amsterdam.

The advantage of radio in charter work was proved again last week when Capt. Morton took off in the Rapide in thick fog for Warsaw

Incidentally, the Calcutta charter mentioned a fortnight ago arrived in the scheduled time of six days. Certain excitements occurred during the return journey when Arabs set fire to the Lydda airport buildings, but the pilot managed to take off before any damage was done.

Fen Ditton Replaced

EXACTLY a week ago Fen Ditton aerodrome, Cambridge, which has served the town as a landing ground and training school since 1929, was closed and the new aerodrome, at Teversham Corner, on the Newmarket Road, was opened on the following day.

During these eight years Fen Ditton has given the initial training to many hundreds of pupils and in 1936 alone 88 new pupils obtained their "A" licences and 45 obtained their renewals at Marshall's Flying School. In addition to Marshall's, the aerodrome has been the headquarters of the Cambridge Aero Club and the University Aero Club, Ltd. All three are moving to the new quarters.

The old aerodrome was on the small side and Marshall's were determined that any future development they might undertake should be on a site big enough to enable them to develop a first-class aerodrome for good. The new aerodrome, when fully completed, will give runways of between 1,300 and 1,600 yards in all directions, which is greatly in excess of the Air Ministry's requirements. The first main hangar is now completed, its dimensions being such as will enable the largest of air liners to be accommodated. Built out from the main hangar are the engine overhaul shops, engine test beds, paint shops, stores, works offices and mess room. The other two buildings which are now being constructed and which will be ready for use early in the New Year, will be the control building and an hotel.

The new aerodrome is almost as near to the centre of Cambridge as the old one was—which is an important point.

Photographic Deviation

ACCORDING to investigations made by a U.S. Bureau of Air Commerce inspector, it seems that the presence of a photoelectric light meter, such as are used a good deal by more enthusiastic photographers, can have a very marked effect on the compass reading. Even at a distance of 18in. from the compass it was found that the error was 10-15 deg. Quite a number of pilots use these meters—or cameras with such devices built therein—and the point is worth remembering.

Juhu Improvements

BY next year the development of Juhu aerodrome, Bombay, should be complete. It is expected that as from the next monsoon it will not be necessary to use Poona. Waterlogging and the absence of proper runways for monsoon take-offs have hitherto been Juhu's serious drawbacks. The former has already been removed and proper runways are in process of construction. Facilities for night flying have been provided, and a D/F station is being laid out.

Air Mail News

TO celebrate this year's Stamp Exhibition, held in London last week, a number of labels were issued which—while not pretending to be stamps nor to have any postal validity—will form interesting souvenirs of the event. One design, produced in miniature sheets of six labels each, printed in blue, illustrates a Short Empire flying boat.

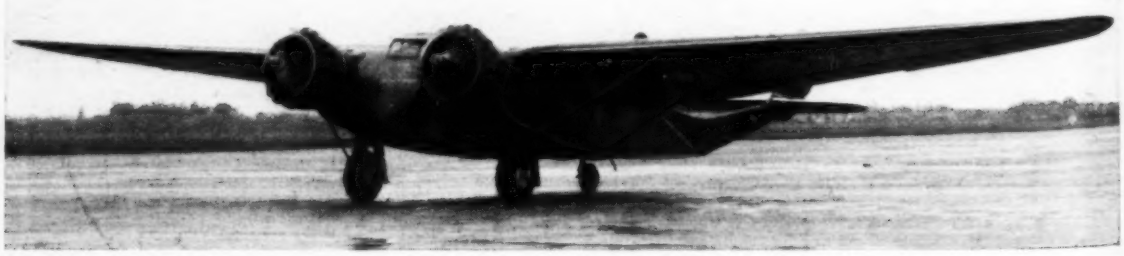
Among the best things shown in the exhibition was a collection illustrating the history of British inland air-mail services, formed privately by Mr. A. Phillips, of Newport, Mon., and showing many scarce flown covers, as well as documentation in the form of time-tables and photographs of some of the machines used.

Suspension of operations for the winter after a very short season will give added value to covers flown on two northern air routes of 1937; the Stavanger-Newcastle service of Allied Airways (Gandar Dower), Ltd., and the Stockholm-Moscow service that was operated jointly by ABA and Aeroflot. It is not likely that vast quantities of mail have been carried on either—especially as on Allied Airways covers were not carried from England, but only to England from Norway. For the first flight the company issued in Stavanger a special envelope with small pictures of a D.H.86. A cachet commemorating the event was applied, presumably by the Norwegian postal authorities.

Stockholm-Moscow first flight covers, on the other hand, are distinguishable only by the date (July 1) which appears in a circular airmail postmark including also a line drawing of a monoplane.

Incidentally, the use of aeroplane pictorial postmarks on envelopes not sent by air seems to be growing. These marks, suggesting that the recipient should use the air mail, are a form of publicity that costs nobody anything, and is rarely overlooked by him. America and Germany are among the companies that have made most use of it in the past, and an interesting recent mark is also German. It records the two hundred and fiftieth crossing of the South Atlantic by German mail aircraft, and gives a rough sketch of one of the Dornier flying boats which, in co-operation with mother ships, are used to operate the service.

Switzerland also has an air-mail propaganda postmark for ordinary mail, and this illustrates with remarkable fidelity one of the old Lockheed Orion monoplanes of Swissair. The wording is bilingual.



THE BURNELLI IN ENGLAND: On Monday of this week the American version of the Burnelli was flown over to Croydon from Rotterdam by Mr. S. V. Morton. The owner is Sir Cunliffe Owen, who originally entered this or a similar machine in the abandoned Atlantic race.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News : Official Announcements : Military Aviation Abroad

The State of Expansion

SINCE the Government decided, in May, 1935, to expand the Royal Air Force, the following progress has been made: Twenty-five new stations and armament training camps have been opened and twenty-one more sites have been selected; some 3,850 pilots have been chosen and about 3,500 more have already completed, or are in the course of, training; the number of airmen who have entered from the same date totals some 25,200. In addition, approximately 4,840 boys are being trained at Halton and Cranwell as aircraft apprentices, and elsewhere 960 boy entrants are under instruction.

A Reconnaissance Wing in the Mediterranean

NO. 1 (General Reconnaissance) Wing commenced to form at Malta on September 23 and moved to Arzeu (near Oran, on the Algerian Coast) on September 30. It is located in H.M.S. *Cyclops*.

The temporary wing comprises Nos. 209 and 210 (General Reconnaissance) Squadrons and is administered by the A.O.C., Royal Air Force, Mediterranean.

The postal address of the unit is: No. 1 (General Reconnaissance) Wing, H.M.S. *Cyclops*, c/o G.P.O., London.

H.M.S. *Cyclops* is a submarine depot ship of 11,300 tons.

The Aden Command

IT is notified in Air Ministry orders that in future the Headquarters of the Aden Command shall be known as "Air Headquarters." It has been agreed with the War Office that the Army Headquarters shall be known as "Headquarters, British Army Troops, Aden."

Aden, which has recently been transferred from the Indian Empire to the care of the Colonial Office, is one of those sections of the Empire where defence is the responsibility of the Air Force. The correct title of the Command is "British Forces in Aden." The military units, which consist of a heavy battery and A.A. Section, R.A., and a Fortress Company, R.E., are under the general command of the Air Officer Commanding.

R.A.F. Station, Farnborough

THE R.A.F. Station, Farnborough, will be transferred to the Fighter Command and placed in No. 22 (Army Co-operation) Group with effect from November 1.

The School of Photography will remain directly under No. 24 (Training) Group for technical administration.

No. 2 (A.C.) Squadron Reunion

IT is proposed to hold a dinner in London on Friday, December 10, to celebrate the silver jubilee of No. 2 (A.C.) Squadron. Officers who have served in the Squadron at any time since its formation in 1912, and who feel that their addresses may not be known, are asked to communicate with the Adjutant, No. 2 (A.C.) Squadron, R.A.F., Hawkinge, Kent.

The Observer's Wing Revived

THE Air Ministry has decided to introduce a badge for air observers the design of which will follow that granted to observers in the Great War. It will be issued and worn under the same general conditions as apply to the pilot's flying badge. For the present Air Officers Commanding will authorise the wearing of the badge when an airman has (1) passed the air observer's course, (2) served in a squadron for at least six months, (3) completed at least fifty hours' flying as air observer, and (4) been recommended by his C.O.

This order will be welcomed in the Service. The old war-time badge of a capital "O" surmounted by a single wing is still occasionally seen on the tunics of officers employed on special work. Though everyone in the R.A.F. coveted the pilot's wings above everything else, a special honour attached to the observer's single wing, as that could only be won during the Great War by spending so many hours in the air over the lines; whereas a pilot had to gain his wings before he was allowed to fly at all at the front—and some pilots never got there. The revived observer's badge cannot be won in the same dangerous and honourable conditions, but none the less the modern qualified observer well deserves the distinction, for his work is arduous and responsible.

ASPECT RATIO: Vickers Wellesleys of a unit which demonstrated before our German guests at Mildenhall, as recorded on page 426c.

Apparently this order only affects airmen. Naval observers are either officers or ratings of the Royal Navy, and over them the Air Ministry has no control. Cases will probably arise when R.A.F. officers ought to receive some form of observer's badge, and we might suggest the case of balloon observers, some of whom have not been allowed (perhaps for reasons of health) to qualify for the pilot's wings, and therefore have no distinguishing badge on their uniforms.

A.C. Training

ARMY co-operation units worked with all Army Commands during the past quarter as part of Brigade, Divisional, Inter-Divisional and other exercises.

A flight of No. 26 (A.C.) Squadron was sent to Leuchars for three weeks to work with various Territorial units camping in Scotland. Certain other squadrons were moved into the East Anglian manœuvre area and other aerodromes were used as follows: No. 2 Squadron, Friday Wood; No. 4, Mildenhall, Stradishall, Debden and Duxford; No. 13, Sawbridgeworth and Henlow; No. 16, Okehampton.

On one notable occasion No. 16 (A.C.) Squadron, to quote an official source, "actually produced thirty-eight sorties in one day while co-operating with the Third Division."

Two bomber squadrons (Nos. 18 and 57) and two fighter units (Nos. 29 and 64) also took part in Army Exercises, the pilots receiving practice in observing military movements. Low-flying attacks were made on numerous Regular and Territorial units.

Artillery co-operation at Artillery Practice Camps was provided as follows: Redesdale, No. 26 Squadron; Okehampton, Nos. 4, 13 and 16; Larkhill, Nos. 2, 13 and 16; West Down, Nos. 16, 13, 4 and 2.

One shoot was conducted with a Naval battery and an R.A.F. pilot, using Army procedure. All three Services reported favourably.

Apart from the normal photographic activity, photographs were used to study various forms of camouflage for tents and other objects.

A Vickers Valentia bomber-transport was allotted to No. 50 (A.C.) Wing from May to the end of July, and several troop-carrying exercises were conducted by all Commands. One of these, with the Southern Command, was to test the supply of mechanised forces by air. The aircraft were a Bristol Bombay and a Handley Page. Rations, spare parts, petrol and oil were flown from Andover to Boscombe Down.

About 169 flights were made and 2,960 troops were carried.

No. 16 (A.C.) Squadron now regards it as normal to work with a tank instead of the more usual R.A.F. tender. It will be realised that the problem of communication with aircraft is rendered more difficult by the fact that armoured formations cannot be accompanied by R.A.F. wireless tenders, which are non-fighting vehicles and require protection.

No. 53 (A.C.) Squadron, which, together with No. 59 (A.C.) Squadron, is paying special attention to training in night reconnaissance, gained some valuable experience while working in the Aldershot Command Administrative Exercises. The differences between day and night reconnaissances were well brought out, particularly as regards the necessity of exploiting the smallest clue to the maximum extent. Differentiation between civil and military movement is at

ever-present difficulty during exercises in peace time, but the correct use of flares has been practised, and ground forces have been exercised in the special precautions necessary for the avoidance of observation by aircraft after dark

Long Service and Good Conduct Medal

THE Long Service and Good Conduct Medal has been awarded to the undermentioned airmen:—

W.O.s Bastin, F. E., Bibby, R., Campbell, J., Earl, J. G., Marsh, W. G. B., Matthews, W. M., Sexton, T., W.O.2 Pond, W. J., Flt. Sgts. Allan, F. J., Bailey, J. H. E., Beattie, G., Beauchamp, G. H., M.M., Bloomfield, E. R., Buckley, M., Burt, W. F., Canham, S. F., Chamberlain, E. G., Chambers, H., Chivers, S. C., Colley, O., Collick, L. A., Cook, J., Cushing, W. L., Davies, C. W. A., Drake, G. S., Ebbutt, J. W., Edwards, H. S., Farey, G., Franklin, W. H., Gentry, E. S., Harris, C. A., Hatcher, T., Howard, R. H., Hunt, B., Jackson, R. T., Jaffrey, F. G., Jennings, W. H., Jones, H., Lawrance, W. G., Lillico, P. R., Lowe, F., McCabe, S. G., McGinn, J. B., McIntyre, M., Moors, J., Newsam, R., Newson, W. G., Nicklin, W. N., Palmer, C. H., Reid, A. C., Richardson, W. D., Robbins, L. C., Roberts, T., Rodber, R. H., Rolfe, C. E., Sharman, A., Simmonds, H. C., Skingsley, E. R., Skinner, B. J., Slade, A., Smith, S. W., Snowling, E. E., Soper, W., Tonkin, F. J., Twigg, T. W., Wagstaff, B. H., Wake, G., Watson, W. W., Welsh, A. H., Williams, J. F., Wooberry, E. G., Woof, E. R., A/Sgt. Abbott, F. S., Sgts. Adams, G. B., Appleby, L., Armstrong, F. E., Bailey, W. S. V., Baldock, A. E., Beard, J., Bessant, J. W., Billman, S. A., Bond, C. W. J., Bowles, S. W., Bragg, W. J. A., Brennan, W. C., A/Sgts. Brisbane, G. W., Brooker, W. J. G., Sgts. Brown, H. P., Bryan, T., Buley, G. R., A/Sgt. Burrows, E. E., Sgts. Carlrae, E., Ceasar, R., Chapman, S., Cherrington, G., Chislett, H. N., A/Sgt. Chiverton, L. R., Sgts. Clements, T. A., Collick, A. A., D.S.M., Davey, R. C., A/Sgt. Davidson, W., Sgts. Deag, J. S., Ealey, H. P., Edward, A. M., Edwards, T. F., Finnerty, F. J. B., A/Sgts. Flatters, A. S., Frain, J. (deceased), Fulcher, W., Sgt. Fursman, A. W., A/Sgt. Gadd, E., Sgts. Gerrard, A., Gregory, W. J., Hailey, A., A/Sgt. Hall, J., Sgts. Hammond, W. S., Harrall, C. A., Harrison, B., A/Sgt. Haskell, B., Sgt. Hayton, R. C., A/Sgts. Hennessey, E. V., Herbert, F. W., Sgts. Holmes, W., Humpage, C., James, W. J., Joseph, W. J. H., Killick, S. P., Laird, A., Little, C. E., A/Sgt. Long, J. H., Sgt. Margry, F. A., A/Sgts. Morris, S., Murray, N. J., Sgts. Palfreman, J. E., Pearson, R. H. A., Peart, F. C., Phillips, H. D. Pontin, C. O., A/Sgts. Popple, J. H., Potter, P. S. J., Sgts. Price, B. F., Price, S. J., Robinson, F. A., D.F.M., Ryall, A. E., Sarney, G., Saul, J. E., A/Sgt. Scott, G., Sgt. Scouse, R. V., A/Sgt. Simpson, F., Sgt. Simpson, G. H., A/Sgt. Smellie, R. W., Sgt. Smith, T., A/Sgt. Spaulding, W. J., Sgts. Stallard, F. A., Statham, H. R., Taylor, R., A/Sgts. Thorpe, W. E., Tizard, W. J. Sgt. Townsend, A. F., A/Sgt. Turner, C. J., Sgts. Turner, J. W., Twineham, W., Tyrrell, A. J., White, H. W. E., Winsor, F. A., Woodborne, R., Cpls. Allison, J. J., Ashley, R. C., Bayman, H., Borland, J. G. C., Brown, H. A., Burrows, J. S., Clarke, H. J., Coleman, H. C., Dade, P. S., Easterbrook, G. H., Edwards, D., Hancock, P., Hayward, E. G., Hick, C. H., Ingram, G. H., Kay, J., Kelly, F. A., McMullon, G. E. T., Moss, A. E., Moylan, A. J., Page, W. A., Percival, W. E., Potter, A. V., Powell, C. B., Rainbow, G., Theobald, T. W., Tuck, A. J., Voaden, T. H., Wasley, R., Witheridge, S. P., L.A/C.s Brown, W. H. F., Glanfield, B., Harrison, A. W., Kinder, E. I., Rowett, F. E., Smith, F. M., Taber, E. H., A/C.1 Hennessy, A.

Royal Air Force Intelligence

Appointments.

General Duties Branch

Wing Commanders.—J. Noakes, A.F.C., M.M., to H.M.S. *Furious*; for duty as Senior Air Force Officer, 20.9.37. J. W. Woodhouse, D.S.O., M.C., to R.A.F. Station, Bircham Newton; to command, vice Wing Cdr. H. M. K. Brown, 27.9.37. H. M. K. Brown, to Headquarters, Coastal Command, Lee-on-the-Solent; for Armament duties, 27.9.37.

Squadron Leaders.—G. G. Walker, M.C., to Headquarters, No. 24 (T.) Group, Halton; for Personnel Staff duties, 16.9.37. H. R. Bardon, to Marine Aircraft Experimental Establishment, Felixstowe; for Engineer duties, 26.9.37. H. N. Thornton, M.B.E., to Directorate of Intelligence, Air Ministry, 1.10.37. G. F. Simond, to No. 100 (T.B.) Squadron, Seletar, Singapore; to command, 13.9.37.

Flight Lieutenants.—A. J. D. Harding, to No. 810 (T.S.R.) Squadron, 24.9.37. F. W. Dixon-Wright, to No. 8 Armament Training Camp, Evanton, 1.10.37. W. Pickersgill, to Marine Aircraft Experimental Establishment, Felixstowe, 21.9.37. U. Y. Shannon, to No. 30 (B.) Squadron, Dhibban, Iraq, 5.10.37. G. D. Green, to No. 11 Flying Training School, Wittering, 4.10.37. L. J. Crosbie, to No. 23 (F.) Squadron, Northolt, 1.10.37. R. B. Harrison, to Headquarters, No. 6 (Auxiliary) Group, London, 11.10.37. M. Hastings, to R.A.F. College, Cranwell, 23.9.37.

Equipment Branch

Squadron Leader.—S. Bingham, to Home Aircraft Depot, Henlow; for Equipment duties, 28.9.37.

Flight Lieutenant.—C. H. Baker, M.B.E., to No. 3 Equipment Depot, Milton, 30.9.37.

Medical Branch

Squadron Leader.—N. I. Smith, to Aircraft Depot, Karachi, India; for duty as Medical Officer, 5.10.37.

Flight Lieutenant.—P. J. McNally, to R.A.F. General Hospital, Hinaidi, Iraq, 5.10.37.

Chaplains Branch

Revd. A. S. Giles, B.A., to Headquarters, R.A.F. Far East, Singapore, Straits Settlements; for duty as Chaplain (C. of E.), 8.10.37. Revd. F. E. H. Trevor, to Home Aircraft Depot, Henlow; for duty as Chaplain (C. of E.), 27.9.37.

Owing to the greatly increased length of these lists as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above.

FOREIGN SERVICE NEWS

Dive Bombing Indicted

A SENIOR officer of the Danish Naval Air Service, discussing dive bombing tactics, is reported to have said that the Danes intend to abandon this form of attack because the Germans have come to the conclusion that the highest velocity attainable by the bomber is insufficient to increase materially the penetrative power of the bomb and that the method of attack would be unduly costly in casualties

German dive-bomber squadrons, incidentally, are normally equipped with Hornet-engined Henschel single-seaters or with a special machine, the function of which is low attack rather than dive bombing proper. A recent issue of German Air Ministry orders, laying down rewards payable to finders of towed targets, mentions a "dive bombing towed target."

Czech Armament

THE armament of some of the newest Czechoslovakian prototypes is not without interest. Letov has turned out a two-seater fighter with two guns in the wing and another pair over the rear cockpit. A three-seater twin-engined reconnaissance type by the same makers has four wing guns and a fifth weapon firing below the tail, which may mean that "attack" is a secondary duty. The Avia 35 fighter is said to resemble a Hurricane but has a Hispano Suiza V cannon-engine and two synchronised machine guns.

A "MOTHER" FOR MONOPLANES: The U.S.S. *Yorktown*, America's newest aircraft carrier, which will, in all probability, be allotted units flying monoplanes. *Yorktown* displaces 19,900 tons and represents a trend toward carriers of much lower tonnage than the *Lexington* and *Saratoga*.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

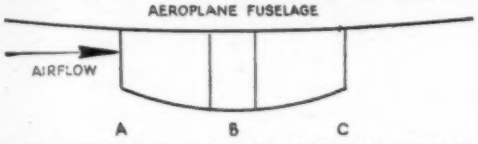
COOLING PROBLEMS

ON one or two occasions recently the statement has been made that it should be possible by suitable cowling design to recover some of the heat energy now carried away by the air flow over the cylinders of an air-cooled engine or through the radiator of a water-cooled one.

In addition, the tentative suggestion has been advanced that it might even be possible to devise a kind of jet propulsion heat engine on similar lines.

I do not know whether any tests have been carried out to confirm or disprove these theories, but take the risk of being confronted by irrefutable experimental evidence in their support.

My first objection is that the whole scheme is a direct contradiction of Newton's Laws of Motion. Referring to the diagram, the effect of imparting heat to the airflow as it passes through the radiator B is first of all to raise the temperature and pressure.



Now this increase in pressure at the radiator (over and above that given by the ordinary Bernouilli Equation, has two effects: (1) It increases the momentum of the outgoing air; (2) It reduces the momentum of the incoming air, because the air in travelling from A to B has to climb up a steeper pressure gradient than if there were no radiator present.

Let P_A = pressure at A. V_A = velocity at A. E = energy given to unit mass of air by radiator.

The suffix ^{1} refers to the same quantities with the radiator in position.

Bernouillis Equation gives

$$\frac{P_A}{\rho} + \frac{V_A^2}{2} = \frac{P_B}{\rho} + \frac{V_B^2}{2} \text{ (without radiator)}$$

Now $P^1_B = P_B + E\rho$.

$$\therefore \frac{P_A^1}{\rho} + \frac{V_A^{1^2}}{2} = \frac{(P_B + E\rho)}{\rho} + \frac{V_B^{1^2}}{2} \text{ (with radiator).} \quad .. \quad (1)$$

If $V_A^1 = V_A$ and $V_B^1 = V_B$

$$\text{Then } \frac{P_A^1}{\rho} + \frac{V_A^2}{2} = \frac{(P_B + E\rho)}{\rho} + \frac{V_B^2}{2}$$

$$\text{Or } \frac{P_A^1}{\rho} = \left(\frac{P_B}{\rho} + E\right) + \frac{V_B^2}{2} - \frac{V_A^2}{2}$$

$$= \frac{P_A}{\rho} + E$$

That is to say the pressure in front of the radiator is greater than atmospheric if the mass of air flowing is to be unchanged. If, on the other hand, we assume $P_A^1 = P_A$, we have from (1) replacing V_B by kV_A and V_B^1 by kV_A^1 (where $k = \frac{\text{Area at } A}{\text{Area at } B.}$)

$$\frac{P_A}{\rho} + \frac{V_A^{1^2}}{2} = \frac{P_B}{\rho} + E + \frac{k^2 V_{A^1}^2}{2}$$

$$\text{Now } \frac{P_A}{\rho} - \frac{P_B}{\rho} = \frac{V_B^2}{2} - \frac{V_A^2}{2} = \frac{k^2 V_A^2}{2} - \frac{V_A^2}{2}$$

$$\therefore \frac{V_A^2}{2}(k^2 - 1) = \frac{V_A^{1^2}}{2}(k^2 - 1) + E$$

or V_A^1 is less than V_A

or the mass of air flowing through the radiator is reduced.

Moreover it is exceedingly difficult to imagine how the reaction of the accelerating airstream (in addition to the normal acceleration given by Bernouilli's Theorem) could be transmitted to the aeroplane.

The only direction, if surface friction be neglected, in which a gas can transmit a force to a solid body is in a direction normal to the surface of the body.

Finally, it would appear that whatever system of channels, ducts and venturies with suitable heating surfaces one might devise, no resultant forward thrust could be obtained if the airflow were continuous, for the gain in energy due to heating surfaces would be balanced by the work done in bringing the air up to the heating surface against the increased pressure.

RICHARD M. HELSDEN, B.Sc., A.F.R.Ae.S.

Coventry.

STRESSED-SKIN CONSTRUCTION

MR. W. TYE, in his very interesting article, "Stressed-Skin Construction," which appeared in the *Aircraft Engineer* supplement to *Flight* for August, 1937, did not, in deriving formulæ for the secondary loading of stringers and rings, take into consideration that a certain part of the primary loading is taken by the stringers (equations 1 and 2).

He thus overestimates the secondary loading of stringers and rings by some 18÷35 per cent. Co-efficients smaller than unity depending on the ratio:

$$\frac{\text{area of the cross-section of stringers}}{\text{area of the cross-section of the shell}}$$

should be introduced into formulæ for W_n, N, W_t and T, due to bending and direct shear. These coefficients would be larger in the case of W_n and N than in the case of W_t and T, for when we take the area of the cross-section of the stringers into consideration $\frac{I}{\bar{I}}$ will decrease more than $\frac{\int y.di}{\bar{I}}$

Pilsen. M. M. GOLOLOBOV.

Death of "Dasher" Blake

IT is with very great regret that *Flight* records the death, in tragic circumstances, of Flt. Lt. A. M. Blake, A.F.C., chief test pilot to Blackburn Aircraft, Ltd., at his home in Hull on October 16.

Alfred Montague Blake learnt to fly at the old South Coast Flying School, which he joined in 1912. In 1914 he went to Russia to take up a post in the aircraft department of the Baltic Waggon Works, Petrograd. He returned in October, 1914, and joined the A.I.D. In June, 1915, he was granted a commission in the Royal Naval Air Service and was posted to the station at Chelmsford in command of night flying.

In 1916 Blake was transferred to No. 2 Wing, Eastern Mediterranean Squadron, and in 1917 he returned and was posted to Redcar, where, in 1918, he took up duties as Flight Commander at No. 2 School of Special Flying. After the war Blake held a number of different appointments, and left the Service in 1926 to go to Rhodesia for the Aircraft Operating Company.

Blake was engaged by the Blackburn company to pilot Mr. Charles Blackburn on two demonstration tours in a Blackburn Bluebird in 1927, and at the conclusion of the tours he was appointed chief test pilot, a post which he occupied until his death. The many Blackburn types produced by Blackburns at Brough since that time were all tested by Blake, whose calm and deliberate attention to details and amazing memory for facts and figures were of the greatest service to the company. Personally he was the most unassuming of men and avoided publicity whenever he could. The loss of "Dasher" Blake is a severe blow to all who had the privilege of knowing him.

About Kingsford-Smith

"Cæsar of the Skies," by Flying Officer Beau Sheil (formerly Personal Assistant to Sir Charles Kingsford-Smith), in collaboration with Colin Simpson; Cassell and Co., Ltd., 8s. 6d.

THE book is described on the jacket as "The Official Life of Sir Charles Kingsford-Smith." Exactly what constitutes an "official" life of a private person is not very clear. Perhaps this expression has been used because another biography of the late Sir Charles was published not very long ago. This book gives some details of the early life of the great Australian pilot, which were not included in the last biography, and it is interesting to learn about his war experiences, how he gained his Military Cross, and how he was wounded in air combat.

THE INDUSTRY

Hillson Appointment

MR. A. R. SARUP, until recently chief engineer and manager of the Oldham Aircraft Construction Co., Ltd., has resigned that post in order to take up an appointment as works manager of the aircraft factory of F. Hills and Sons, Ltd., makers of the Hillson Praga.

Mr. Norman Sykes is the Hillson chief designer.

Non-corroding Steels

CHARACTERISTICS of Hadfield's "ERA" non-corroding steels, together with machining, welding and other working data, are given in a new brochure issued by the makers, Hadfields, Ltd., Hecla Works, Sheffield.

These steels are available in forgings, bars, castings, sheets, strips, wires and seamless tubes.

The B.A.M. at Play

PROVIDING, as they do, unlimited opportunities for members of the staff and friends, whether of the trade or otherwise, to meet in a rather more genial atmosphere than usual, staff dances are always both useful and interesting. That held by the British Aircraft Manufacturing Company at the Hanworth Park Hotel last Friday was no exception, and Mr. F. T. Walden, who took over the job of organising the party, had no difficulty in disposing of his 150-odd tickets. Towards the end of the evening there was only just enough room on the dance floor to accommodate those extra guests who usually drift in from elsewhere—when all other forms of amusement have closed down.

NEW COMPANIES.

AERO BOURNE LTD.—Private company, registered October 13. Capital, £100 in 100 shares of £1 each. Objects: To carry on business as aeronautical experts, consultants, etc. The directors are: Cecil F. T. Clayton and Mrs. Alice Clayton. Registered Office: Stafford Lane, Stafford Road, Bournemouth.

GILLETT STEPHEN AND CO., LTD.: Registered as a private company on October 11, with a nominal capital of £325,000. Objects: To acquire the goodwill and freehold property and other assets of the business of engineers carried on by G. S. Vendors (formerly Gillett Stephen and Co. Ltd.) at Atlas Works, Bookham, Surrey, and to carry on the business of manufacturers of and dealers in all kinds of armaments, accessories, components, equipments, machinery and apparatus, including aircraft, engines, guns, rifles, munitions, explosives or projectiles, etc. The first directors are to be appointed by the subscribers. Solicitors: Godden, Holme and Ward, 34, Old Jewry, London, E.C.2.

PERIFER LTD.—Private company, registered October 14. Capital, £100 in 400 shares of 5s. each. Objects: To acquire patents, inventions and secret processes relating to aeroplane propellers, and to carry on the business of makers and manufacturers of aeroplanes, seaplanes, and other aircraft and all parts, etc. The directors are: Peter W. A. Dudgeon, Comte Jean P. M. J. de G. de la Valdene, John K. Flower. Registered Office: Millais House, 7, Cromwell Place, London, S.W.7.

PUBLICATIONS RECEIVED.

The Journal of the Royal Air Force College, Autumn, 1937. Gale and Polden, London.

French War Birds, by "Vigilant." 8s. 6d. John Hamilton Ltd., 32, Bloomsbury Street, London, W.C.1.

Aircraft of the British Empire, 1937, by L. Bridgman, 3rd edition, 5s. Sampson Low, Marston and Co., 100, Southwark Street, London, S.E.1.

Handbook of Aeronautics: Part II. Performance, by Capt. R. N. Liptrot. 6s. Sir Isaac Pitman and Sons, Ltd.

Machine Drawing for Students, by F. J. Pryer, 7s. 6d. Sir Isaac Pitman and Sons Ltd.

Zeppelin, by Capt. E. A. Lehmann; 15s., Longmans, Green and Co., Ltd., 39, Paternoster Row, London, E.C.4.

Caesar of the Skies: The Official Life of Sir Charles Kingsford-Smith, by Beau Sheil; 8s. 6d., Cassell and Co., Ltd., La Belle Sauvage, London, E.C.4.

Economics of Air Transport, by S. J. Noel-Brown; 6s., Sir Isaac Pitman and Sons, Ltd.

The Next War, by Air Comdre. L. E. O. Charlton; 9d., Longmans, Green and Co., Ltd., 39, Paternoster Row, E.C.4.

Shell Air Route Schedule from London to Cairo, 10s. Shell-Mex and B.P. Ltd., Aviation Dept., Shell-Mex House, London, W.C.2, or from booksellers.

Aeronautical Research Committee Reports and Memoranda. Report No. 1699: Report on Puss Moth Accidents, complete with Appendices, 30s. H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2.

I Wanted Wings, by Beirne Lay, 10s. 6d. Chapman and Hall, Ltd., 11, Henrietta Street, Strand, London, W.C.2.

Air Publication No. 1529: The "Q" Code and other abbreviations to be used in the Civil Aeronautical Radio Service, 1s. H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2.

National Advisory Committee for Aeronautics. Report No. 589: An Analysis of Lateral Stability in Power-Off Flight with Charts for Use in Design, by C. H. Zimmerman, 10 cents. No. 590: Pressure-Distribution Measurements on an 0-2H Airplane in Flight, by H. A. Pearson, 15 cents, No. 591: An Analytical and Experimental Study of the Effect of Periodic Blade Twist on the Thrust, Torque, and Flapping Motion of an Autogiro Rotor, by J. B. Wheatley, 10 cents., No. 593: Cooling of Airplane Engines at Low Air Speeds, by T. Theodorsen, M. J. Brevoort and G. W. Stickle, 10 cents. No. 595: Full-Scale Tests of a New Type N.A.C.A. Nose-Slot Cowling, by T. Theodorsen, M. J. Brevoort, G. W. Stickle and M. N. Gough, 10 cents. No. 596: Cooling Tests of a Single-Row Radial Engine with Several N.A.C.A. Cowlings by M. J. Brevoort, G. W. Stickle and H. H. Ellerbrock, Jr., 10 cents. No. 597: Air Propellers in Yaw, by E. P. Lesley, G. F. Worley and S. Moy, 10 cents. No. 598: Alternating-Current Equipment for the Measurement of Fluctuations of Air Speed in Turbulent Flow, by W. C. Mock, Jr., 10 cents. No. 599: Flight Tests of the Drag and Torque of the Propeller in Terminal-Velocity Dives, by R. V. Rhode and H. A. Pearson, 10 cents. No. 600: An Analysis of the Factors that Determine the Periodic Twist of an Autogiro Rotor Blade, with a Comparison of Predicted and Measured Results, by J. B. Wheatley, 10 cents. Superintendent of Documents, Washington, D.C., U.S.A.

AERONAUTICAL PATENT SPECIFICATIONS.

(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.).

(*Published October* 14, 1937.)

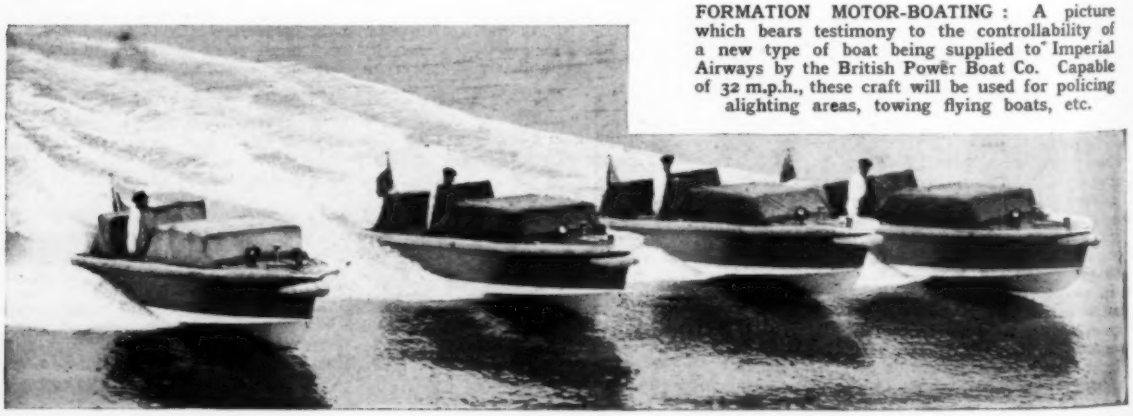
915. ARMSTRONG, WHITWORTH AND CO. (ENGINEERS) LTD., SIR W. G., and ROSS, R.: Retractable steps for use on vehicles (471,892).
4244. MOSS, D. G. K., and PEIRCE, H. C. (trading as MECHANISM): Gyroscopic navigational instruments (471,895).
7663. ELLOR, J. E.: Cooling systems for aircraft engines (471,926).
8422. SIEMENS APPARATE UNDE MASCHINEN GES: Regulation of the power output of aircraft motors (472,177).
10901. DELANNE, M. H.: Landing gear for aircraft (471,944).
11578. DELANNE, M. H.: Aircraft (471,946).
12041. PINCKNEY, V.: Magnetic compasses for ships and aircraft (472,186).
28377. JUNKERS FLUGZEUG-UND-MOTORENWERKE AKT.-GES: Gun mountings for aircraft (472,096).
9048. SOC. FRANCAISE RADIO-ELECTRIQUE: Navigation-aiding radio systems (472,155).

(*Published October* 21, 1937.)

4705. LEIGH, W.: Bomb sights for flying-machines (472,392).
8108. MAINA J.: Aircraft propulsion (472,318).
8232. BRISTOL AEROPLANE CO. LTD., and FEDDEN, A. H. R.: Valve gear for multi-cylinder internal-combustion engines (472,268).
8758. MAYO, R. H.: Aircraft (472,546).
8762. CIERVA AUTOGIRO CO. LTD.: Aircraft with autorotative wings (472,547).
9276. AIR-EQUIPMENT: Power plant for use on aircraft (472,412).
10372. ELLOR, J. E., and PARAVICINI, T. P. de: Cooling of air-cooled internal-combustion engines for aircraft (472,334).
10373. ELLOR, J. E. and PARAVICINI, T. P. de: Aircraft (472,555).
23758. LUTTMAN, H. C.: Aerofoils with variable camber (472,567).
32317. SOC. ANON. DES APPAREILS G. A. L.: Cooling radiator for aircraft engines (472,576).
35147. SAULNIER, R.: Removable roof for the cockpit of aircraft (472,366).
12018. CIERVA AUTOGIRO CO. LTD.: Aircraft with autorotative wings (472,306).

(*Published October* 28, 1937.)

8981. TAMMEO, F.; Aeroplanes convertible from monoplanes to biplanes or vice versa (472,642).
9064. ELLOR, J. E. and PARAVICINI, T. P. de: Cooling of engines of aircraft (472,820).
9517. SUPERMARINE AVIATION WORKS (VICKERS) LTD., and MITCHELL, R. J.: Construction of wings for aircraft (472,839).
9625. BENDIX AVIATION CORPORATION: Anti-vibration supports for instruments (472,906).
9897. MARTIN, J.: Control surfaces for the wings of aeroplanes (472,845).
9948. SOC. ANON. DE CONSTRUCTIONS AERONAUTIQUES. S.A.C.A.: Sights for aerial bombing (473,000).
11428. TENNANT, W. J. (Aktiebolaget Ljungstroms Angturbin): Propulsion units for aircraft (472,850).
25224. SPERRY GYROSCOPE CO., LTD., and HARDING, W. G.: Liquid pendulums for gyro compasses (472,779).
34854. LORENZ AKT.-GES., C.: Radio systems for direction-indicating and position finding (472,733).



FORMATION MOTOR-BOATING: A picture which bears testimony to the controllability of a new type of boat being supplied to Imperial Airways by the British Power Boat Co. Capable of 32 m.p.h., these craft will be used for policing alighting areas, towing flying boats, etc.

The AIRCRAFT ENGINEER

"FLIGHT" ENGINEERING SECTION

No. 141. (Volume XV No. 4) 12th Year October 28, 1937.

LONGITUDINAL STABILITY

A Comparison of Characteristics with Elevators Fixed and Free

By H. B. IRVING, B.Sc., F.R.Ae.S.

THE wide adoption of the monoplane, with its relatively great wing chord for a given wing area, has brought into prominence questions of longitudinal stability which scarcely arose in the days of the biplane.

The longitudinal stability of an aeroplane with elevators free is usually less than with elevators fixed. Since it is generally considered to be desirable that an aeroplane should be longitudinally stable with elevators free as well as with elevators fixed, it is advantageous in keeping down tail size (and drag) to reduce the loss of stability with elevators free to as small an amount as is conveniently possible. Whether or not designers generally bear this in mind in designing the tailplane and elevators, and deliberately try to reduce the loss of stability with free elevators, is not clear. At all events, the published data which would give one guidance on the question are few.

The present note points out the factors affecting the stability with stick free and reproduces some existing data which indicate the possibility of reducing the loss or even making some gain in stability with stick free. Further data are required.

Stability with Free Elevators

If we neglect the weight moment due to the elevators, i.e., if we assume that the elevators are mass balanced, the lift coefficient of the tailplane for the free elevator condition may be expressed (Ref. 1) in the form

$$C'_L = \left(a_1 - a_2 \frac{b_1}{b_2}\right) \alpha'$$

where

a_1 is the slope of the tailplane lift-incidence curve.

a_2 is the slope of the tailplane lift-elevator angle curve.

b_1 is the slope of the elevator hinge-moment-incidence curve.

b_2 is the slope of the elevator hinge-moment-elevator angle curve.

α' is the incidence of the tailplane.

Accordingly the longitudinal stability of an aeroplane in gliding flights increased by a greater or less amount by freeing the stick, according to the sign and magnitude of the quantity

$$a_2 \frac{b_1}{b_2}$$

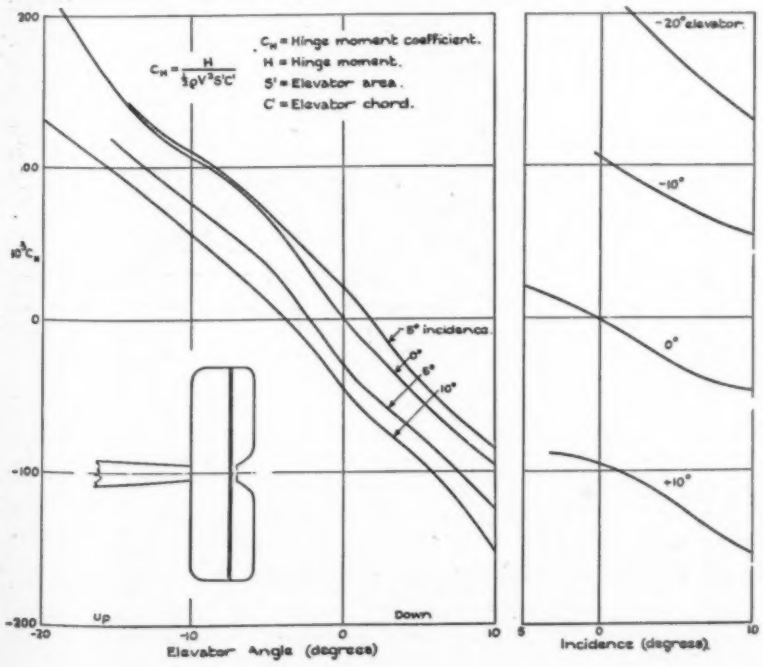


Fig. 1.—Hinge Moments on Unbalanced Elevators of 0.4 chord.

(1) Glauert, H.—The Longitudinal Stability of an Aeroplane in Gliding Flight. R. & M. 638. September, 1919.

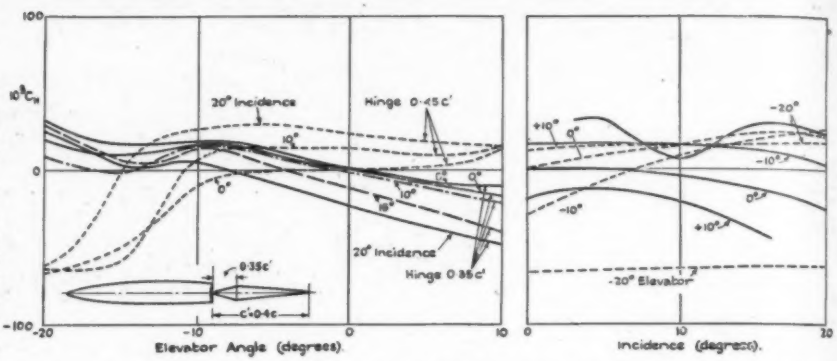


Fig. 2.—Hinge Moments on Martin M.1 Elevators.

When this quantity is positive, as is more usually the case, the stability is decreased by freeing the elevators.

It will readily be seen that in practice the factor governing whether the stability is increased or decreased by freeing the stick is the sign of b_1 (slope of elevator hinge moment-tail plane incidence curve). For a_2 is always positive and b_2 must be negative. If not, the elevators will, of course, be overbalanced.

Therefore one would like b_1, if negative, to be small; or to be positive, in which case the stability with stick free would be greater than with stick fixed.

For ordinary unbalanced elevators of normal size b_1 is negative—that is, the elevators tend to blow up as the incidence increases—and the stability is reduced on freeing the elevators, as one would expect.

If we take elevators of 0.4 chord, say, a_2 is about two-thirds of a_1 and b_2 is about twice b_1. In such a case the contribution of the tailplane to the stability of the aeroplane is reduced by about 33 per cent. by freeing the elevators. If the margin of stability with stick fixed were small this might, of course, mean a change over to instability on freeing the stick.

With reduction in size of elevators the loss in stability on freeing the stick becomes less (Ref. 2) from the point of view of stick-free stability, then, it is generally better to keep the elevator chord as small as is compatible with obtaining the maximum control required.

Balanced Elevators

A change of sign of b_1 from its usual negative value may be brought about by balancing. It is possible to have b_1 of either sign according to the type and degree of balance adopted, but there does not appear to be enough information to enable the designer so to proportion his elevators as to be certain that b_1 is of the desired sign and magnitude; and it is the writer's impression that b_1 is usually left to take care of itself. The result is that if b_2 is made small (close balance) and b_1 happens to be of the wrong sign (negative) there may be a serious loss of stability on freeing the stick.

An indication as to the present position is given in the accompanying figures by the results for ordinary unbalanced elevators of 0.4 chord (Ref. 3), for the Martin M.I. elevators with set-back hinge (taken from Miss Bradfield's report (Ref. 4) on the balancing of controls) and for horn-balanced ailerons on the Nieuport "London" wing (Ref. 5).

The right-hand set of curves for the Martin elevators (Fig. 2) show that, when the elevator hinge is at 0.35 of the chord, giving a fairly close balance (see left-hand curves) b_1 is on the whole small and negative. It is only by setting the hinge further back (see dotted curves) so as to make the elevators overbalanced over part of the range that a change of sign of b_1 to the positive is obtained.

On the other hand, Fig. 3 for the horn-balanced ailerons shows that even when the horn gives comparatively little balance in respect of elevator movement it makes the sigh of b_1 favourable (positive) over part of the range of incidence and elevator angle. With a horn giving some overbalance strikingly large positive values of b_1 are obtained.

It would appear, therefore, bearing in mind that a set-back hinge is not usually placed further aft than 0.3 of the chord, that while balancing by this method reduces the large negative value of b_1 obtained with ordinary unbalanced elevators, it is not likely to lead to b_1 becoming positive. But the outside horn, even when it gives only moderate balance, should make b_1 positive.

Thus, from the point of view of stability with stick free it seems that there is something to be said for the horn balance. There may, however, be disadvantages, such as the effect of yaw on the balance; this certainly

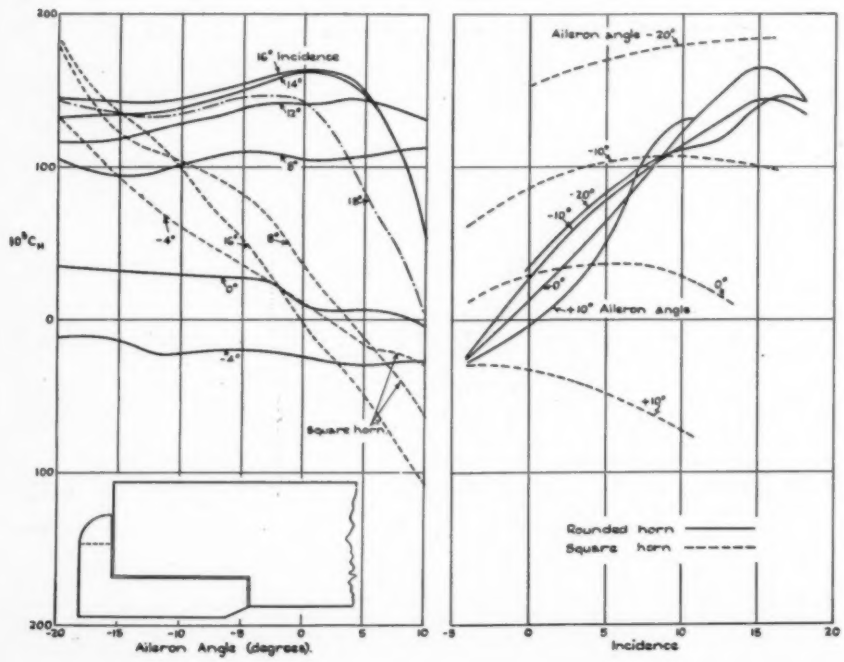


Fig. 3.—Hinge Moments on Nieuport "London" Ailerons.

(2) Glauert, H.—Full-scale Experiments with Elevators of Different Sizes. R. & M. 409. December, 1917.

(3) Irving, H. B., Batson, A. S.—Modern Experiments on the Pitching Moment and Hinge Moment due to Elevators of Various Sizes on the BE 2c Tailplane. R. & M. 679. June, 1920.

(4) Bradfield, F. B.—Wind Tunnel Data on the Balancing of Controls. R. & M. 1420. May, 1931.

(5) Irving and Batson.—An Investigation of the Aerodynamic Properties of Ailerons. Part IV. The Effect of Yaw on the Balance of Ailerons of the "Horn" Type. R. & M. 728. September, 1920.

applies in the case of ailerons, but the case is rather different from that of elevators, and may be affected by the advent of wing flaps obviating the need for side-slipping.

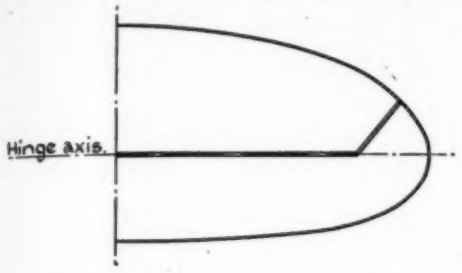


Fig. 4.—Form of Balance Embodying Set-back Hinge and Outside Horn.

Possibly a combination of set-back hinge plus moderate outside horn balance might be found which would be satisfactory. Such a combination is in effect given by the type of oblique horn balance sketched in Fig. 4. This type is in fairly common use in America and elsewhere and some data on the values of b_1 and b_2 which it gives would be of interest.

The effect of a geared balance tab on longitudinal stability with stick fixed and free is of interest. The balance tab has no material effect on b_1; it does, of course, reduce both a_2 and b_2, the latter to a greater extent than the former. Thus, if a close balance is obtained by a geared tab there may be a serious diminution in stability with stick free.

[*We shall be glad to have the views of designers on Mr. Irving's interesting contribution.*—ED.]

VARIABLE SPAN and VARIABLE WING AREA

An Investigation of Their Effect on Top Speed and Cruising Speed

By A. E. PARKER, B.Sc.

(*Continued from page 15*)

IT is proposed now to investigate the effect on speed of varying the wing area (but keeping aspect ratio constant) of an aeroplane for a constant all-up weight and a constant thrust horse-power. The landing and take-off of an aeroplane of high wing loading are points which require attention, but these points will not be discussed here as only the effect on speed is being considered. Some form of assisted take-off would be used for an aeroplane having very high wing loading.

Now a particular aeroplane will be considered and it is proposed to choose a machine having an all-up weight of 40,000 lb. The expression for horse-power required for various values of wing area S sq. ft. and forward speed V m.p.h. is given by the expression:

$$P_T = \left(.01 + .06\,C_L^2 + .00614 + \frac{1950}{S}\right)\frac{S\,V^3 \times .00511}{375 \times 2}$$

The expression in the bracket is the total drag coefficient and takes into consideration the variation of profile drag with increase of C_L, the American absolute lift coefficient.* The same aeroplane will be fitted with wings of varying wing area and the best value of the wing area obtained. It is clear that if the wing area of an aeroplane is decreased beyond a certain point a decrease in speed is produced and not an increase, due to the fact that the decrease in profile drag is less than the increase in induced drag.

The performance of the hypothetical aeroplane will now be considered.

Case I.

S = 1,950 sq. ft. Weight 40,000 lbs. $\therefore C_L = \frac{8040}{V^2}$

I	II	III	IV	V	VI
V	C_L	$.06\,C_L^2$	$.06\,C_L^2 + .01614$	$V^3 \times 4.98 \times IV$	T.H.P. $= \frac{DV}{375}$
160	.314	.00592	.02206	2800	1195
180	.248	.00370	.01984	3200	1537
200	.201	.00242	.01856	3695	1970
220	.1662	.00166	.01780	4280	2520

Column V gives the drag in lbs. and column VI the thrust horse-power required.

Case II.

S = 1,433 sq. ft. Weight 40,000 lbs. $\therefore C_L = \frac{10920}{V^2}$

V	C_L	$.06\,C_L^2$	$\frac{C_D}{.06\,C_L^2 + .01836}$	$V^3 \times 3.678 \times C_D$	T.H.P. $= \frac{DV}{375}$
200	.273	.00446	.02282	3365	1790
220	.2255	.00305	.02141	3800	2235
240	.1895	.00215	.02051	4350	2780
230	.2064	.002555	.02092	4070	2500

Case III.

S = 400 sq. ft. Weight 40,000 lbs. $\therefore C_L = \frac{39500}{V^2}$

V	C_L	$.06\,C_L^2$	$.06\,C_L^2 + .0399$	$V^3 \times 1.022 \times IV$	T.H.P. $= \frac{DV}{375}$
160	1.543	.1428	.1827	4850	2065
188	1.22	.0893	.1292	4280	2050
200	.988	.0585	.0984	4025	2145
220	.816	.0399	.0798	3950	2320
240	.686	.0282	.0681	4015	2560

Case IV.

S = 1,000 sq. ft. $\therefore C_L = \frac{15650}{V^2}$

V	C_L	$.06\,C_L^2$	$.06\,C_L^2 + .02196$	$V^3 \times 2.555 \times IV$	$\frac{DV}{375}$
200	.3915	.00918	.03114	3170	1390
220	.323	.00628	.02824	2480	2045
240	.2717	.00443	.02639	3880	2480

Case V.

S = 750 sq. ft. $\therefore C_L = \frac{20880}{V^2}$

V	C_L	$.06\,C_L^2$	$.06\,C_L^2 + .02596$	$V^3 \times 1.915 \times IV$	$\frac{DV}{375}$
200	.522	.0163	.03826	2920	1555
220	.4313	.01115	.03711	3430	2020
240	.3625	.00778	.03374	3720	2380

Case VI.

$S = 600$ sq. ft. $\quad \therefore C_L = \dfrac{26110}{V^2}$

V	C_L	$.06\,C_L^2$	$.06\,C_L^2 + .02996$	$V^2 \times 1.532 \times IV$	$\frac{DV}{375}$
200	.6525	.0255	.05546	3400	1810
220	.5390	.0174	.04736	3510	2060
240	.4530	.0123	.04226	3755	2400

The results given in the foregoing tables have been exhibited in graphical form, Fig. 3. It will be seen that for a horse-power of 2,160 and wing area 1,950 sq. ft. the speed is 207 m.p.h.; and that for the same horse-power but a wing area of 1,433 sq. ft. the speed is 216.8, i.e., an increase of 9.8 m.p.h. which is about the same as found in Part I of this paper.

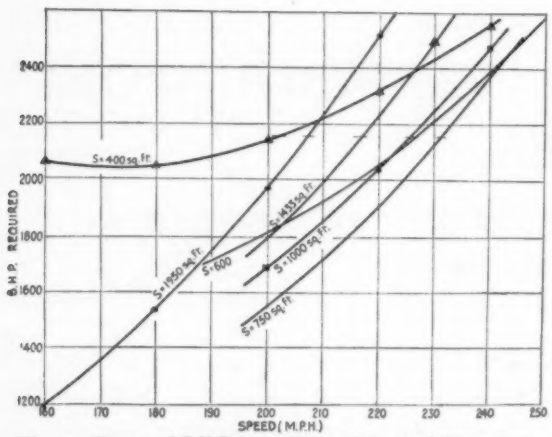


Fig. 3.—Curves of T.H.P. required against speed for various values of wing area. Constant all-up weight, 40,000 lb.

Now from the curves in Fig. 3 the curves of Fig. 4 have been obtained by drawing lines horizontally corresponding to various horse-powers and reading off the speed and wing area corresponding to that horse-power. It is clear at once from Fig. 4 that the greatest speed with a given horse-power is obtained by having a wing area of about 700 sq. ft., i.e., a wing loading of $\dfrac{40000}{700} = 57$ lb. per sq. ft., and by increasing the wing loading more than this there is a big drop in speed.

It follows that for this particular aeroplane the greatest speed to be obtained with 2,160 h.p. (this is thrust-horse-power) is 231.5 m.p.h., and this speed is obtained when the

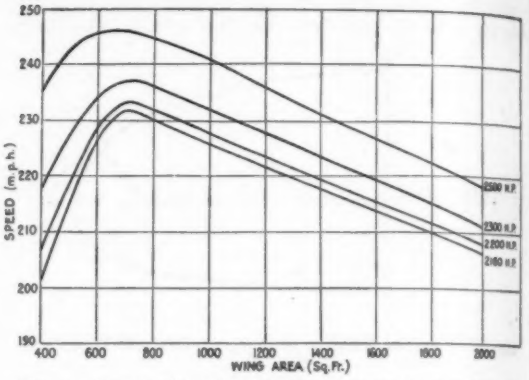


Fig. 4.—Curves of speed-wing area for various values of thrust-horse-power. Constant all-up weight, 40,000 lb.

wing area is 700 sq. ft. Now let a journey of 3,000 miles be considered and a cruising horse-power of 2,160 h.p. be available. Consider the two cases, wing area 1,950 sq. ft. and wing area 700 sq. ft.

For plane having 1,950 sq. ft.

$$\text{Time of flight at 207 m.p.h.} = \frac{3000}{207} = 14.48 \text{ hr.}$$

For plane having 700 sq. ft.

$$\text{Time of flight at 231.5 m.p.h.} = \frac{3000}{231.5} = 12.95 \text{ hr.}$$

Assume a petrol consumption of .5 pints per brake-horse-power per hour and a b.h.p. of 2640.†

Petrol load required
(1,950 sq. ft. craft) $= 2640 \times .5 \times 1.02 \times 14.48 = 19500$

Petrol load required
(700 sq. ft. craft) $= 2640 \times .5 \times 1.02 \times 12.95 = 17430$

i.e., a saving in petrol load of 2,170 lb.

This does not seem a very big saving in weight, but it might make all the difference between being able to carry a payload and not being able to carry one. A smaller machine might show up better in this respect and, of course, the all-wing type of aeroplane would be ideal because in conventional aeroplanes there is the resistance of the cabin which cannot be reduced. A machine having a very slim fuselage would show a better increase in speed due to decreasing the wing area because the body drag would be a smaller percentage of the total drag.

The calculations throughout this article were for sea-level conditions.

* See article by W. R. Andrews in *The Aircraft Engineer*, June, 1932, "The Estimation of Profile Drag."

† The thrust-horse power is assumed to be 82% of this, i.e., 2,160 h.p.

For the Draughtsman

A SPECIAL study of the requirements of the engineering draughtsman is made by the famous Bavarian firm of pencil manufacturers, A. W. Faber—who, incidentally, have just celebrated their 167th anniversary.

The Faber "Castell" drawing pencil is made in eighteen accurately graded degrees of hardness, and has, it is stated, exceptionally even density of impression and unusual resistance to pressure when sharpened to a fine point. Another product is the "Castell Polychromos" series of pencils, made in no fewer than 64 light-proof colours.

Thirdly, the Faber concern makes engineers' slide rules in a variety of types.

Wellworthy Ring Clamps

IT is announced by Wellworthy Piston Rings, Ltd., that as from November 1, the price of the Wellworthy-Simplex piston ring clamp will be reduced to 1s. 6d. retail. The practice of issuing these clamps on loan against a deposit will then be discontinued, and clamps issued prior to November 1, for which a refund is required, must be returned to the depot of origin before December 1.

Electrical Wear and Waste

THERE are two questions which the firm of Evershed and Vignoles, Ltd., put to works managers: (1) "Is the insulation resistance of cables and electrical machines in your premises up to the standard required by the regulations of the Institution of Electrical Engineers?" (2) "Are all conduits and cable armourings earthed, and is the current-carrying capacity of the bonding up to that of the conduit itself?"

These questions depend upon just how much wear and tear cables in works have been submitted to, and the answers indicate whether there is danger of fire and injury to employees and whether current is being wasted.

Two small "Megger" instruments, which can be simply used by a works electrician, will answer these important questions in a few minutes. Particulars are obtainable from the makers at their Chiswick, London, W.4, works.

Gasketry

A 200-page catalogue of every conceivable type of gasket has been issued by J. Payen, Ltd., of Church Street, Chiswick, W.4. The numerical index shows more than 9,500 different products for automobile, motor cycle and aero engines, each type being illustrated, numbered and priced.

GYROPLANE and AUTOGIRO

Some Comments on Herr Hafner's Paper

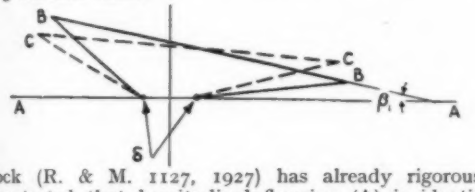
By Dr. J. A. J. BENNETT, A.F.R.Ae.S.

HAVING been intimately associated with the late Juan de la Cierva, I cannot refrain from making a few comments regarding Herr Hafner's paper.

First, may I say that Herr Hafner is to be congratulated on designing such a neat and spectacular machine and for successfully incorporating in it a method of direct control which, though fundamentally identical to that used in the "Autogiro,"* has some interesting constructional features.

The lecturer himself acknowledges that the resemblance between the A.R.III type of control and that of the C.30 is greater than at first appears superficially, and states that the cyclic variation of incidence imposed on the blades of a C.30 by tilting the hub is identical to that on the blades of the A.R.III when the spider or "false hub" is tilted by the control, the maximum and minimum angle of incidence occurring 90° displaced in azimuth from the direction of tilt.

The "false hub" type of direct control was first applied to the gyroplane by de la Cierva and patented by him in November, 1932, but was discarded in his production designs in favour of the mechanically simpler method of tilting the hub itself.



Lock (R. & M. 1127, 1927) has already rigorously demonstrated that longitudinal flapping (A) is identical to transverse feathering (B) and, in fact, that the gyroplane may be considered as either flapping or feathering according to whether one chooses as the plane of reference (A) the plane (AA, Fig. 1) normal to the rotational axle (i.e., axis of the main hub bearings) or (B) the plane (BB, Fig. 1) normal to the rotational axis (i.e., axis of rotation of the blade tips).

When the longitudinal flapping is due to the dissymmetry of forward flight it is accompanied by transverse flapping

$$(A)^1 \quad \Delta\beta^1 = -\beta_1{}^1 \sin\psi, \ \theta = \theta_0,$$

when the effect of the coning angle is taken into account, and $(A)^1$ is identical to longitudinal feathering

$$(B)^1 \quad \Delta\theta^1 = \beta_1{}^1 \cos\psi, \ \beta = \beta_0.$$

When the flapping hinge δ is at right angles to the longitudinal axis of the blade the plane BB is inclined backward with respect to the plane AA at the angle β_1.

When, however, the flapping hinge δ lying in the plane AA, makes an angle δ_3 (de la Cierva's notation) with the normal to the longitudinal axis of the blade, i.e., an angle $(90° - \delta_3)$ on the leading side of the blade between the δ hinge axis and the longitudinal radial axis of the blade, the plane (CC, Fig. 1) normal to the axis of rotation of the blade tips makes an angle less than β_1 to the plane AA. This intermediate system

$$(C) \quad \begin{cases} \Delta\theta = \beta_1 \sin\delta_3 \cos(\psi + \delta_3) \\ \Delta\beta = -\beta_1 \cos\delta_3 \cos(\psi + \delta_3) \end{cases}$$

is the general system of which (A) and (B) are the particular cases of $\delta_3 = 0$ and $\delta_3 = 90°$ respectively. The amplitude of $\Delta\theta$ is $\beta_1 \sin\delta_3$ and of $\Delta\beta$ is $\beta_1 \cos\delta_3$ and since the displacement about the δ hinge is the vectorial sum of $\Delta\theta$ and $\Delta\beta$ the amplitude of hinge displacement is β_1, as it is in the two extreme systems (A) and (B) considered by Lock. Hence the main effect of a small δ_3 is merely a phase displacement of the maximum values of $\Delta\theta$ and β, the effect on the amplitude of flapping being relatively small as $\Delta\beta$ is reduced only by $\beta_1 (1 - \cos\delta_3)$.

When either the hub or "false hub" is tilted by the control stick, flapping does not immediately take place because the blade tips are moving along a definite path and the inertia of the blade elements prevents a sudden displacement from this path. The initial effect of movement of the control column is to cause a cyclic variation in blade incidence and it is this relay action which gives the appropriate cyclic variation of lift to effect the required lift vector tilt.

The amount of longitudinal ($\Delta\beta$) or lateral ($\Delta\beta^1$) flapping, in the sense of longitudinal or lateral tilt of the plane of rotation respectively with respect to the plane AA, associated with the cyclic variation of blade incidence depends on the value of δ_3. When $\delta_3 \to 90°$, $\Delta\beta \to 0$, i.e., the "rotational axle" becomes coincident with the "rotational axis."

Whether or not the blades "flap" and/or change pitch cyclically is determined by whatever we choose as plane of reference about which flapping occurs. The azimuth position of maximum flapping and/or pitch change is also so determined. The effect of δ_3 therefore is equivalent to displacing the plane of reference from that (AA) normally chosen.

Flapping hinges, having a δ_3 angle other than zero so that displacement of the blade about the hinge has a feathering component $\Delta\theta$ associated with the flapping component $\Delta\beta$, were first used in gyroplanes by de la Cierva and patented by him in November, 1925. Although not used in the C.30, they were used in the direct take-off "autogiros" demonstrated last year and are a feature of the new C.40, a direct take-off type of "Autogiro" now being supplied to the Air Ministry.

In the Hafner gyroplane the δ hinge has two component hinges so that the component displacements $\Delta\beta$ and $\Delta\theta$ of the blade are associated with (i) a flapping hinge having $\delta_3 = 0$ and (ii) a torsional hinge respectively. Component hinges, i.e., hinges the displacements about the axles of which are mechanically interconnected, are commonly used in engineering, and, although de la Cierva preferred to use a single hinge rather than two component hinges in order to suppress play, the latter are used in other types of gyroplanes.

Tension Members

The particular part of the Hafner rotor to which most attention has been directed is the torsionally flexible tension member used for carrying the centrifugal force of the blade. This type of suspension is useful when friction would be detrimental and has already been proposed in the case of V.P. airscrews. The frictional moment of the ball and other bearings used in "Autogiros" is so small that no one can say that any friction at all can be felt in the controls. In only one instance did de la Cierva find it necessary to use torsionally flexible tension members and that was in the case of an oscillating bearing, the operating moments about which were very small. In this case the friction of standard bearings would have suppressed entirely the required oscillation and a torsionally flexible tension thrust bearing was developed in November, 1936. Fortunately, however, such a sensitive system was not necessary and friction no longer plays an important part in the mechanism of the "Autogiro."

With regard to the "restoring moment due to the torsional elasticity which tends to stabilise the blades at a predetermined incidence," in the "Autogiro" this restoring moment is supplied only by centrifugal force and the use of mechanical means for this purpose is not favoured.

Coming now to the question of direct take-off it is incorrect to say that jump take-off as demonstrated by the

*The word "Autogiro" is the registered trade mark of the Cierva Autogiro Company.

"Autogiro" converted the kinetic energy of the rotor inefficiently due to the high induced airflow. Actually, the kinetic energy is most efficiently converted into potential energy the more sudden the change in pitch, and in the type of jump take-off demonstrated last year by the "Autogiro" and filmed by *Flight* the machine "towered" right from the top of the jump. That the change of pitch is effected automatically does not necessarily mean that the change of pitch is sudden. In fact, de la Cierva intended that the rate of change of pitch should be controlled so that any quality of direct take-off from "towering" to pure vertical "jumping" could be achieved and he patented suitable means for obtaining this result in January, 1935. It is considered that multiplication of manual controls is a retrograde step and that a manual control for effecting pitch change for take-off is undesirable, as consistent use of the control in the most effective manner is probably beyond the capacity even of an expert pilot.

The lecturer states that his theoretical analysis differs from earlier publications in so far as the behaviour of an "ideal" rotor is assumed as a premise. Surely some reference to Schrenk's theory of the gyroplane (ZFM, 1933, Nos. 15, 16 and 17) should have been made because the conception of such an "ideal" rotor was first presented by Schrenk. In fact, Fig. 10 of Hafner's paper showing the plan form of an "ideal" rotor is merely a reproduction of Fig. 3 of Schrenk's paper.

An analysis of the vertical descent as a basis for the forward flight case is Schrenk's method, and the formulae developed and conclusions regarding the effect of low disc loading, high value of $\frac{C_L^3}{C_D \rho^2}$ for the blade section and low blade loading are clearly Schrenk's.

The lecturer further states that his analysis shows that in a steadily autorotating rotor, although the torque at the hub is zero, an inner portion of the disc acting as a windmill drives the outer portion which is acting as a helicopter. This was demonstrated in a paper which I published in German several years ago when studying at Göttingen (ZFM, 1932, No. 8).

The use of a very low tip speed ratio λ, i.e., high rotor r.p.m., is a very crude way of decreasing the adverse effect of the dissymmetry of forward flight and only a very high $\frac{HP}{W}$ ratio as used in A.R.III permits such a waste of horse-power.

Moreover, the lecturer claims that, by interlapping the flapping hinges in such a way that the hinge axes intersect the rotor axis and each other at the "focal point," undesirable moments in the control are eliminated. De la Cierva was the first to show the desirability of such a "co-axial" arrangement and this point is discussed at length in his patent specification No. 393976 of December, 1931. He also showed, however, that a "co-axial" arrangement was undesirable for other reasons and that the best practical compromise was an arrangement not exactly "co-axial" but nearly so.

That the C.30 controls were heavy and subject to undesirable moments was no fault of the hub arrangement, but was due to the periodic blade twist associated with the aerofoil section Göttingen 606. De la Cierva correctly analysed the effect of this periodic twist of the blade on the controls and as a result of a report communicated by him to the Aeronautical Research Committee, a report was published by Beavan and Lock (R. & M. 1727, 1936) giving the final results of the investigation. By using an aerofoil section of zero pitching moment, or by making the blades more torsionally rigid, the undesirable moments in the C.30 controls can be eliminated.

In the C.40 controls further refinements have been incorporated and, without resorting to the academic requirements of hinge co-axiality and frictionless suspension, the controls satisfy the practical requirements of lightness, stability and freedom from undesirable moments.

The question of manœuvrability has scarcely been mentioned in the lecture, though this feature of A.R.III has been stressed in Press reports of demonstrations of this machine. I need only say that there is no reason why a high degree of manœuvrability cannot be incorporated in the design of a gyroplane, nor why a spectacular aerobatic gyroplane should not be constructed for demonstration purposes, but the primary utility value of a gyroplane is safety, and therefore only a limited amount of manœuvrability is desirable.

AIRSCREW PERFORMANCE

Mr. F. M. Thomas's Interesting and Unorthodox Approach to a Difficult Subject

UNORTHODOXY is, perhaps, the word which best describes the paper on "Practical Airscrew Performance" given to the Royal Aeronautical Society last week. The joint authors of the paper were Mr. F. M. Thomas, Mr. F. W. Caldwell and Mr. T. B. Rhines. That paper is a very unusual analysis of airscrew problems based, not upon aerodynamic theory, but upon the great mass of test data which has gradually been accumulated on the subject of airscrews. The paper is likely to remain for many years the standard work of reference and one might almost say the standard text book on the subject of practical airscrew performance calculations as applied to the estimate of aircraft performance. The paper was far too long to be read in its entirety and a further unorthodox feature was introduced by Mr. F. M. Thomas in reading not so much a summary of the paper as a discussion of it from the point of view of the authors.

Mr. Thomas first surveyed the background of theoretical airscrew aerodynamics and then explained by the aid of diagrams the essential principles of the method presented in the paper. He next summarised the types of general problem to which the method lends itself and finally dwelt at some length on the gaps in available published data indicating the fields in which research is most needed.

The lecturer said that the audience might feel he and his co-authors had reduced a majestic science, resplendent with double integral signs and a time-honoured ritual, to what was little more than a few new definitions and a few processes of arithmetic. If that was the impression he was glad because that was the object of the work.

Most of those who had carried out complete aeroplane performance calculations had been thoroughly annoyed at the complexity of the airscrew portion of the work. No two engineers approached a broad problem with the same point of view or with the same method of attack. At one end of the scale one had the specialist in theory who would explain or predict anything with the aid of a few differential equations. At the other end was the pure pragmatist. Mr. Thomas thought there was an element of pathos in the fact that the theorist was in a continually losing struggle to keep up with the purely practical man. The struggle was particularly acute in aerodynamics. Pure hydrodynamic theory was, perhaps, as complex and precise as any theory but, however nice the theory might be, the form of a fairing on a strut connection was most likely to be determined by someone who had been watching a seagull.

Before presenting a résumé of the method of analysis which was particularly suited to the categorical arrangement of test data, Mr. Thomas paused for a moment over theories and, although admitting their value to the specialist and reseach worker, he did not seem to have a very high opinion of theories when it came to practical airscrew work.

The test of any engineering practice was not only how accurate it was, but also how smoothly it fitted into an administrative scheme. In this respect the blade element theory fell down badly in that its use required too much time and experience to produce reasonably correct answers to pressing production problems. They therefore turned to methods of analysing test data which were more statistical than aerodynamic.

In outlining the methods evolved by the authors of the paper, Mr. Thomas said that when the performance calculator had surveyed a particular problem and decided on certain general features, the first step in choosing an airscrew was

to select an appropriate diameter. He showed a curve of V/nD plotted against the speed power coefficient Cs. The curves showed the V/nD which would give the maximum efficiency for any set of operating conditions. The speed power coefficient Cs was used because it was easily calculated from the design conditions and did not involve diameter.

Certain corrections had to be applied before the correct answer could be found, for instance, if the blades were especially wide they would absorb more power and hence the curves for high activity factors would lie above the standard curves. Those for low activity factors would lie below it. Corrections also had to be applied for the effects of blade section and thickness in order to obtain the maximum V/nD.

The next step was to find the blade angle that went with the diameter found. A single curve was shown on the screen by the lecturer, but in the printed paper there were parallel curves for Clark Y and R.A.F. section aerofoils. Certain other effects on blade angle also had to be taken into account. These included the ratio of blade thickness to blade chord, the ratio of body diameter to airscrew diameter, and the effective tip speed. Curves were shown of these correction factors to be applied to blade angles.

In practice one hardly ever used the diameter found for maximum efficiency, but, instead, one used a larger or smaller diameter. There might be various reasons for this. For example, the aeroplane design might limit the diameter, or it might become desirable to compromise on efficiency at the design condition in order to obtain better performance at another height or air speed. It was seen that an increase in diameter caused a large reduction in angle. An increase in thickness to chord ratio, on the other hand, caused a small reduction in angle. Similar effects resulted from increases in the size of the body behind the airscrew and from an increase in tip speed. In computing the effective of tip speed, allowances were made systematically for the rotational speed, the forward speed of the aeroplane, for aerofoil thickness and angle of attack, and also for the effect of height which caused changes in the speed of sound.

Efficiency

Having obtained diameter and blade angle for the design condition, the next step was to obtain the efficiency. A curve showed the envelope or maximum efficiency obtainable with different values of V/nD. Again certain corrections had to be applied, such as for activity factor, thickness to chord ratio, body diameter to airscrew diameter and effective tip speed. The curve indicated that wide blades caused reduction in efficiency; thick blades at low tip speed caused smaller losses. If an airscrew was put directly in front of a large body, the losses would be very high. If the tip speed was much higher than 1,000ft. per second, enormous losses would occur. Strangely enough, one could use an airscrew which was quite a lot larger or smaller than that used for maximum efficiency without suffering very great losses.

Having finished with the design condition of the airscrew, which was usually maximum or cruising speed, the lecturer proceeded to the estimation of the performance at other conditions of flight. The diameter and shape of the blade remained, of course, the same, but the airspeed, altitude, engine power, engine speed and blade angle changed. A curve was given showing only the major variables. The minor variables were allowed for in a set of correction factors. If the airscrew had wide blades it would use more revs in a climb than if it had narrow blades. R.A.F. sections lost less than Clark sections and thick blades lost less than thin ones, and the use of thick sections on variable-pitch airscrews resulted in smaller blade angle variations. On the other hand, if the aeroplane was fast and the engine had a low gear, the required blade angle change to keep constant r.p.m. would be large. The use of over-size blades required larger blade angle changes than the use of undersize blades.

Having evaluated the factors governing power absorption on climb, the lecturer mentioned that the same method was used to cover cases at still lower air speed, namely, at the end of the take-off, but pointed out that for the start of the take-off a different method was used. A separate curve was used to show the blade angle required to absorb the required power at the required revs at zero air speed. An allowance for the number of blades was made in the equation of power absorption. Static thrust was calculated from an equation based on the momentum theory, because the ordinary efficiency used for high air speeds broke down and became zero at zero air speed. The static thrust efficiency was a primary function of blade angle and tip speed.

Having outlined the first type of use to which the study could be put, Mr. Thomas referred to three others. The first of these was the systematic analysis of general airscrew problems. They would find that the method readily lent itself to estimating how useful high revs were at take-off, in comparison with high power. It was also useful in estimating whether the weight of a two-speed airscrew-reduction gear was likely to be justified. The advantages of allowing in the aeroplane design for ample airscrew diameter, whether or not a variable-pitch airscrew was used, became readily apparent.

The second additional type of use of this study arose from the fact that they had attempted to synthesize *all* airscrew test data. They would find it easy, for instance, to obtain a fairly good idea of the effects many airscrew variables had merely by glancing at the curve sheets.

Variables

The difficulty with airscrew aerodynamics was the tangle caused by the large number of variables which are not negligible. The blade element theory did not provide a sufficiently direct analysis to permit grasping and retaining the mass of facts made available by tests. In putting aside the blade element theory, they had been able to start a new arrangement of the classification into which the various phenomena fall. One interesting fact brought to light was that, contrary to general opinion, allowing an airscrew to freewheel in high pitch achieved practically the same drag as "feathering" or the placing of the airscrew "edge-on."

Mr. Thomas also gave an outline of what he considered the most urgent direction in which research should be made in order to provide data at present not available. For example, the only extensive large-scale data that had been published were on R.A.F. section two-bladed airscrews at blade angles no greater than 28 deg., whereas to-day they were fitting Clark sections to three-bladed airscrews with blade angles of around 50 deg. Full-scale research was also required to give results at low values of V/nD, i.e., during the take-off and at low-climbing speed. The range of blade angles which had been tested was not anywhere near large enough to permit calculations for climb conditions of airscrews with variable pitch. No successful analysis of the effects of body interference had ever been published either based on theory or on test.

Most airscrews were yawed when climbing. Data on a simple yawed case indicated that there was little lost in efficiency due to yaw, but tests of a model airscrew on the leading edge of a wing showed much larger losses with changes in angle of attack.

They really knew very little about tip speed effects. The height correction used was indicated by dimensional theory, but there was as yet no experimental verification of it. Also they were still very much in doubt as to the tip speed at which heavy losses began. Did the loss start suddenly at about 1,000ft. per second, as the N.A.C.A. large-scale data indicated, or was the loss gradual from around 700 or 800ft. per second, as indicated by R. & M. model data?

Wanted

Gaps in the data on airscrew shape characteristics were very numerous. Such full-scale data as had been published concentrated almost entirely on R.A.F. section blades, with only an indication as to how the Clark section airscrews differ. The lecturer knew of no data whatever on airscrews having any of the newer aerofoil sections, some of which appeared attractive for constant-speed airscrews. Data were wanted showing the effects of surface roughness. Calculations based on compressed-air-tunnel results at high Renolds numbers and carried out according to the strip theory, indicated that a fast aeroplane might lose five miles an hour due to roughening the blades by painting. Looked at in another way, this estimated but unchecked loss could be evaluated as a five per cent. increase in fuel consumption.

In conclusion, Mr. Thomas said he thought there was something laughable about the spectacle of technical people trying to talk with each other. Before they got very far they had to lay down a long list of symbols and definitions, and even then they rarely ever quite agreed as to what meant what, in spite of the valiant efforts of the Air Ministry towards standardisation. A technical Esperanto was almost as remote as a linguistic one, and the individual worker was in his own mind a lonely soul talking to himself for comfort.

To-day they heard and read much about the wonderful new species of man called the technician—about how the little scientists of to-day would be the big men of to-morrow. He thought this view of the technician was an exaggeration or anticipation. In reality he was a poor benighted devil. His colleagues attacked him because these and those approximations were unsound. Those above him suspected that he frittered away his time in idle fantasies. Those below him thought him a bit of a medicine man with a flair for hocus-pocus. Those all round were, with some justification, dubious of the degree of his eccentricity. And so he made his weary way, playing rather badly the role of Lord of Creation!

TECHNICAL LITERATURE

SUMMARIES OF A.R.C. REPORTS

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester, 1; St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through booksellers.

ON REYNOLDS NUMBERS OF TRANSITION. By A. Fage, A.R.C.Sc. R. & M. No. 1765. (14 pages and 8 diagrams.) June 6, 1936. Price 2s. net.

When transition from laminar to fully developed turbulent flow occurs in the boundary layer of a body, the transition begins at, or very near, the point where the intensity of laminar friction is a minimum. In general, this point occurs in the region of rising pressure beyond the point of minimum pressure.

In some recent measurements of normal pressure and surface friction on a sphere, a well-defined inflexion in the pressure distribution occurred in the region of minimum laminar friction. This pressure inflexion had a very limited extent compared with that of the transition region, and served to indicate with some precision the point where transition began. The same feature was observed in earlier experiments on a circular cylinder and an aerofoil.

The values of $\delta^* U_e/\nu$ for the circular cylinder, aerofoil, sphere, and flat plate in wind-tunnel streams for which the value of u'/U_0 lies within the range 0.008 to 0.053, where u' is the root mean square of the speed fluctuations from the mean speed, were determined and were found not to depend appreciably on the shape of the body. Over this range, both numbers slowly increase with a decrease in u'/U_0, that is, with the steadiness of the stream. On the flat plate, both $\delta^* U/\nu$ and $\delta^* U_e/\nu$ rise rapidly with an increase in u'/U_0, when u'/U_0 is small. The evidence available is not sufficient to predict the behaviour of the bodies apart from the flat plate in a very steady stream.

Transition of Flow

EXPERIMENTS ON A SPHERE AT CRITICAL RENOLDS NUMBERS. By A. Fage, A.R.C Sc. R. & M No. 1766. (20 pages and 11 diagrams.) September 24, 1936. Price 3s. net.

Information on the transition from laminar to turbulent flow in the boundary layer of a sphere, at Reynolds numbers within the critical range, has been obtained from distributions of normal pressure measured for a 6-in sphere in three wind streams—Open Jet Tunnel No. 2, 7-ft. Tunnel No. 2, and 4-ft. Tunnel No. 2, with extra high resistance honeycomb—and from distributions of surface friction deduced from observations taken with a surface tube, calibrated in position on the sphere.

It is shown that the distribution of normal pressure for a given drag coefficient is independent, within the accuracy of measurement, of the Reynolds number and so of the turbulence in the free stream. Below the critical range, the laminar boundary layer separates from the surface before transition can occur, whilst within this range, the region where transition begins taken to be that where the intensity of laminar friction falls to a minimum, is indicated by a well-defined inflexion in the curve of normal pressure. Transition begins at about $\theta = 95°$ when $C_D = 0.3$.

SOME EXPERIMENTS WITH CASCADES OF AEROFOILS. By A. R. Collar, B.A., B.Sc., of the Aerodynamics Department, N.P.L. R. & M. No. 1768. (7 pages and 5 diagrams.) December 11, 1936. Price 1s. 3d. net.

Experiments were made to find an aerofoil section suitable for use in cascade at right-angle bends in a wind tunnel. A short length of duct, having a cross-section of 12 in. × 15 in., was built into the high pressure end of the N.P.L. open jet tunnel No. 2 for the experiments; wind speeds up to about 200 ft./sec. could be obtained in this duct. The chords of the various sections tested were all of the order of 2 in., so that a Reynolds number of about 2×10^5 could be reached. Measurements of the direction of flow behind the cascades were made with a yaw-meter, while total head tubes were used to find relative pressure losses. The steadiness of flow was indicated by threads.

A section, described as section C, which caused only a very slight constriction of the air passing between the aerofoils, was found to be the most suitable of the sections tested. This section has a thin tail, the tangents to both surfaces at the tail being at right-angles to the incident stream. The experiments indicated that if it is desired to expand the duct section on passing through a cascade, an expansion ratio of about 1.15 should not be exceeded. Again, a polygonal shape is thought to be better than a smooth curve for the section of a duct at a cascade. It also appears that, if the vanes of a cascade are interlaced with thin strips at right-angles to their length, the cascade will also perform the functions of a honeycomb, without undue adverse effect on its efficiency as a cascade.

Airscrew Sections

TESTS OF FOUR AIRSCREW SECTIONS IN THE COMPRESSED AIR TUNNEL. By D. H. Williams, B.Sc., A.F.R.Ae.S., A. F. Brown, B.Sc., and E. Smyth, B.Sc. R. & M. No. 1771. (20 pages and 4 diagrams.) November 26, 1936. Price 3s. net.

Sections C, D, E and F of R. & M. 829*, of thickness ratios 16.8, 12.9, 10.3 and 8.6 per cent. respectively, have been tested at Reynolds numbers varying from 0.3×10^6 to 6×10^6 for C and D and from 0.3×10^6 to 5×10^6 for E and F, at positive lift. Section E has also been tested at negative lift.

The variation of C_L max. with Reynolds number is similar to that found for a series of aerofoils of various thicknesses. For the thickest section, C_L max. decreases as R increases; for the thinner ones, it increases with R. For section F, C_L max. increases from 1.12 at $R = 0.3 \times 10^6$ to 1.72 at $R = 5 \times 10^6$.

* Experiments with a Family of Airscrews including the Effect of Tractor and Pusher Bodies. Part I R. & M 829, November, 1922. Fage, Lock, Howard and Bateman.

TESTS OF R.A.F.34 AT NEGATIVE INCIDENCES AND OF THE EFFECT OF SURFACE ROUGHNESS ON R.A.F.34 WITH SPLIT FLAP IN THE COMPRESSED AIR TUNNEL. By D. H. Williams, B.Sc, A.F.R.Ae.S., and A. F. Brown, B.Sc. R. & M. No. 1772. (11 pages and 3 diagrams.) December 8, 1936. Price 2s. net.

R.A.F. 34 has been tested over a complete range of Reynolds number, at negative incidences up to −30 deg. The maximum (negative) lift coefficient increases rapidly from −0.6 at $R = 0.3 \times 10^6$ to −1.1 at $R = 1.2 \times 10^6$, then gradually to −1.1 at $R = 4.4 \times 10^6$. There is no further increase at higher values of R.

Tests were carried out on R.A.F. 34 with 15 per cent. split flap, in the usual condition and also with the surface coated with carborundum powder, to see whether the loss in maximum lift due to roughness could be recovered by the use of a flap. This is not the case. Plotting the values of maximum lift against R for the aerofoil with and without flap, the curves for the rough condition diverge from those for the smooth aerofoil at the same value of R. In the rough condition, there is no increase in C_L max. with Reynolds number above this point of divergence either with or without flap.

NOTE ON THE DESIGN OF CORNERS IN DUCT SYSTEMS. By G. N. Patterson, Ph.D. Communicated by the Director of Scientific Research, Air Ministry. R. & M No. 1773. (16 pages and 12 diagrams.) October 8, 1936. Price 2s. 6d. net.

A review of investigations on the relation between the resistance and the design of a corner shows that a corner may be designed to give a low resistance without the use of guide vanes. The corner must be rounded and high values chosen for both the ratio of the radius of curvature to the duct width and the ratio of height to width. For the best results the duct must not be terminated immediately after the corner. The loss around a 90 deg. corner may be reduced to 15 per cent. of the velocity head if the ratio radius of curvature/duct width is 3 and the ratio height/width is 6 and the duct extended a length equal to four times the duct width beyond the corner.

A summary of research on the reduction of corner loss through the use of guide vanes is given in which the dependence of corner loss on the gap/chord ratio, incidence and profile of the vanes is discussed. The development of vane profiles for corners of 30 deg., 45 deg., 60 deg. and 90 deg. through the application of aerodynamic theory is outlined. Tests on these vanes show that the loss around a 90 deg. corner is 14 per cent. of the velocity head at a Reynolds number of 4×10^4, where the Reynolds number is based on the mean velocity in the duct and the chord of the vane. Through the use of these vanes a corner in a duct may be designed to have a very low resistance.

Tapered Wings

AERODYNAMIC CHARACTERISTICS OF TAPERED WINGS WITH FLAPS AND SLOTS. By S. H. Hollindale, M.A., Ph.D., D.I.C. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1774. (43 pages and 41 diagrams.) October 30, 1936. Price 6s. net.

A large amount of experimental material is accumulating on the lifting and stalling qualities of tapered wings fitted with flaps and/or slots.[1] The stalling results are characterised by great diversity and a number of anomalies.[2] A fairly comprehensive series of calculations of the effect of flaps and slots on wing characteristics has, therefore, been undertaken with a view to providing some guidance in the interpretation of the experimental results.

Ranges of wing taper, flap span and flap strength have been considered, but attention has been confined to a single aspect ratio. The analysis is limited to flaps whose chord at any section is a constant fraction of the wing chord at that section, and to wings whose chords are unaltered by the operation of the flaps.

The usual Prandtl assumptions of aerofoil theory have been made, and care must be exercised in applying the calculated results to predict the stalling properties of actual wings. A review of the various methods of attacking the problem of the flapped wing is given, together with some comparisons of results, in an appendix.

The addition of a partial span flap delays the stall over the flapped part of the wing, but leads to a premature stall over the unflapped part. Both these effects increase with wing taper and with flap strength. The outboard stall can be cured by tip slots; if slots are used, the stalling qualities improve with increasing taper.

Partial span flaps produce only a small increase in the induced drag of a wing working at a given lift. In the case of a low drag flap (e.g., slotted flap), however, this increase may be quite a large proportion of the total drag caused by the flap.

[1] Split Flaps and other Devices for Facilitating Landing. R. & M. 1659 (1935-36.) (General summary.) S. B. Gates.

[2] Note on the Effect of Auto-slots on Tapered Wings. S. & C. 728. (Unpublished.) S. B. Gates.

EXPERIMENTS ON THE USE OF A STATIC TUBE IN THE WING WAKE AND A SHORT PITOT TUBE IN THE LEADING EDGE AS AN AIRSPEED INDICATOR. By Aerodynamics Staff, R.A.E. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1779. (6 pages and 4 diagrams.) November 10, 1936. Price 1s. net.

Flight tests have been made to see what reductions could be effected in the speed error of a pitot-static head by mounting the static tube in the wing wake at the rear of the trailing edge and the pitot tube immediately in front of the leading edge.

The authors conclude that the device could be developed to give a much improved speed indication at speeds well removed from the stall, but its properties at the stall, and particularly when under the influence of flaps, would be disconcerting to the average pilot.

DIVING

CHARTS EXPRESSING THE TIME, VELOCITY, AND ALTITUDE RELATIONS FOR AN AIRPLANE DIVING IN A STANDARD ATMOSPHERE. By H. A. Pearson, Langley Memorial Aeronautical Laboratory, American N.A.C.A. Technical Note No. 599.

In this report charts are given showing the relation between time velocity, and altitude for aeroplanes having various terminal velocities diving in a standard atmosphere. The range of starting altitudes is from 8,000ft. to 32,000ft., and the terminal velocities vary from 150 m.p.h. to 550 m.p.h. A comparison is made between an experimental case and the results obtained from the charts and examples pointing out the use of the charts are included.

The terminal velocity by which each chart is designated is that which would be obtained in an atmosphere of constant sea level density. The abscissae of the curves are the *true*, not the indicated velocities. The charts, although derived for a vertical dive starting from rest, may be used to include various diving angles and starting velocities.